Available online through
www.jbsoweb.com
ISSN 2321 - 6328

Research Article

# CLINICO-ENDOSCOPIC AND RADIOLOGICAL ASSESSMENT IN THE PRETHERAPEUTIC STAGING OF LARYNGEAL AND HYPOPHARYNGEAL MALIGNANCIES

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Article Received on: 12/08/16 Accepted on: 26/10/16

**DOI: 10.7897/2321-6328.04539**

**ABSTRACT**

Carcinomas of larynx and hypopharynx are the very common primary head and neck malignancies.Incidence is strongly related to age, and is rare before 40 years of age. The larynx and hypopharynx are closely integrated anatomically and functionally. Anatomically larynx is divided into the three sub divisions and certain potential spaces through which cancer tends to spread outside the site of its origin. The causal relationship between alcohol and tobacco intake, genetic predisposition, diet, and socioeconomic conditions in the development of squamous cell cancers of the head and neck applies as well to laryngeal and hypopharyngeal cancer. Site predilection for the origin of cancers of laryngeal cancers being Glottic carcinoma being 60 to 65%, Supraglottic carcinoma 30 to 35% and Subglottic carcinoma less than 5%. Site predilection for the origin of cancers of hypopharyngeal cancers being pyriform Sinus 70%, post cricoid region 15% and posterior pharyngeal wall 15%. Clinico-endoscopic evaluation can be undertaken with indirect laryngoscopy, fibreoptic laryngoscopy / telescopic laryngoscopy ($70^0$ hopkins) and direct laryngoscopy. Imaging (USG, CECT±CEMRI) plays a significant complementary role to clinical endoscopy in pretherapeutic staging of laryngeal and hypo pharyngeal malignancies. Determination of the precise extent of cancer spread within the larynx (T staging) is the single most critical factor guiding treatment decisions in patients with localised laryngeal cancer. In present study out of 25 patients of laryngeal and hypopharyngeal malignancies, 16 (64%) patients were treated by radiotherapy or concurrent chemoradiation, 4 (16%) patients were treated by total laryngectomy with neck dissection and 3 (12%) patient were treated by total laryngectomy with partial pharyngectomy with neck dissection and 2 (8%) patients were treated by total laryngectomy alone.

**Keywords:** Laryngeal and hypopharyrngeal carcinoma; Clinico- endoscopic assessment; Radiological evaluation; Pretherapeutic staging.

## INTRODUCTION

Carcinomas of larynx and hypopharynx are the very common primary head and neck malignancies. Cancer of larynx and hypopharynx accounts for 30 percent and 10 percent of all head and neck cancers respectively.[1] Incidence is strongly related to age, and is rare before 40 years of age. Laryngeal cancer has also a strong socioeconomic association, being twice as common in more deprived groups compared to the more affluent groups.[2] The American Cancer Society's most recent estimates for laryngeal cancer in the United States for 2013 are; About 12,260 new cases are laryngeal cancer being 9680 in men and 2580 in women. The incidence of hypopharyngeal tumors has consistently been about one-third of that of laryngeal cancers. Site predilection for the origin of cancers of laryngeal cancers being; Glottic carcinoma 60 to 65%, Supraglottic carcinoma 30 to 35% and Subglottic carcinoma less than 5%.[3] Squamous cell carcinoma (SCC) is the most common malignant neoplasm of the larynx. One of the most important influences on prognosis is the presence of metastases to the cervical lymph nodes. The causal relationship between alcohol and tobacco intake, genetic predisposition, diet, and socioeconomic conditions in the development of squamous cell cancers of the head and neck applies as well to laryngeal cancer. Chemical carcinogens in the workplace that relate to laryngeal cancer include asbestos, nickel compounds, and certain mineral oils. Glass-wool has been associated with an increased mortality for laryngeal cancer in an Italian study. Hypopharynx is a triangular space extending from level of hyoid bone above to lower border of cricoid cartilage below. It is within this space itself that the larynx is also accommodated anteriorly. Anatomically hypopharynx is composed of three sub-sites; the pyriform sinuses, the posterior cricoid region and posterior pharyngeal wall. The apex of pyriform sinus is situated at the level of cricoid cartilage and is very close to paraglottic space. Tumors involving anterior and medial walls of pyriform sinus can extend anterio-medially into paraglottic space and cause vocal cord fixation by invasion of intrinsic muscles. The arye epiglottic folds separate the endolarynx from medial wall of pyriform sinus bilaterally and form what has been termed as "marginal area". Although arye epiglottic folds are actually part of supraglottic larynx, tumors arising at this site behave aggressively like hypopharyngeal cancers and not supraglottic carcinomas.[4] Regarding site predilection for the origin of cancers of hypopharyngeal cancers; pyriform sinus 70%, post cricoid region 15% and posterior pharyngeal wall 15%.[3] The pyriform fossa is the most common subsite in North America and France. Post cricoids lesions appear more commonly in Northern Europe. The mean age at

presentation is 60 years. Pyriform fossa and post pharyngeal wall have male predominance of 5-20:1 in North America with 50:1 in France. [5,6,7] Post cricoids lesions have a female predominance 1.5:1.[8-10]

**Clinico-endoscopic Evaluation;** Clinico-endoscopic evaluation can be undertaken with Indirect laryngoscopy (I/L), Fibreoptic laryngoscopy (FOL) / Telescopic laryngoscopy ($70^0$ Hopkins) and Direct laryngoscopy. Office endoscopic assessment of the larynx is more useful than evaluation for the extent of disease in the hypopharynx. Flexible endoscope may be passed through hypopharynx and vocal cords, subglottis and trachea examined with ease down to carina. Mucosal extention of disease and cord mobility is better assessed with endoscopy, but submucosal spread is difficult to assess, difficult area to see in the clinic is the posterior surface of epiglottis and similarly the laryngeal ventricle is also difficult to see where the only hint of cancer may be slight fullness in this area. If there is any suspicion of a carcinoma lurking in these areas and in particular if there are associated symptoms such as otalgia, the patient requires an urgent laryngoscopy under general anaesthesia, for endoscopic assessment of the extent of disease and biopsy. It is preferable to concentrate on the laryngeal extent of the lesion after assessment of the hypopharynx (including both piriform sinuses and the postcricoid area) using a full esophagoscopy if indicated. The larynx is brought into complete view, and a photography or drawing is made of the extent of the lesion. Cord mobility is best assessed preoperatively. Movement of vocal cords, the arytenoids joints and the whole hem larynx should be assessed. Invasion of glottic cancer into the muscle layers of vocal cord changes staging and carries poor prognosis, but occasionally mobility may be impaired by bulky size of a tumor and this must be distinguished from actual deep invasion. Lesions of the supra glottis and sub glottis may affect the mobility by direct muscular invasion, cricoarytenoid joint involvement or rarely perineural spread and carry a grave prognosis.[11] The laryngeal probe permits assessment of the extension into the ventricle. Telescopes can be passed through the laryngoscope to assess the subglottic extent and better visualize the anterior commissure. The operating microscope also allows better visualization of the larynx. It is important to obtain biopsy specimens from the obvious tumor and any additional suspicious areas, particularly on the contralateral cord. This is especially needed if a conservation laryngeal procedure is planned.[12] Cervical lymph node involvement play an essential role in the treatment planning and prognosis of laryngeal and hypo pharyngeal cancers. Palpation is the primary method to evaluate the neck node status. However staging of neck by palpation only in patients is known to be inaccurate due to common false/negative and false/positive findings. Supraglottis has a rich lymphatic network and tumors arising from these areas metastases through thyrohyoid along superior laryngeal vessels to juglodigastric nodes. Rates of neck nodal metastasis in supraglottic carcinoma are:- T1 20%, T2 30%, T3 50%, T4 65%. The lymphatics from true vocal cords are sparse, from glottis and sub glottis, they pass through cricothyroid membrane and drain into prelaryngeal (Delphian) and deep cervical nodes along inferior thyroid artery.[13] Cancers of hypopharynx has high propensity for lymphatic invasion and most patients have cervical lymphadenopath at the time of initial presentation. Pyriform sinus tumors metastasize mainly to the jugular lymph nodes (level II, III & VI).[14] The incidence of cervical lymph node metastases from cancer of pyriform sinus tumor is as high as 75% and approximately 10% present with bilateral metastases and if the tumor extends to the posterior hypopharynx, the retropharyngeal node of Ranvier and less frequently in posterior triangle level (V). [15]

**Radiological Evaluation;** Squamous cell carcinoma (SCC) is the most common malignant neoplasm of the larynx and hypopharynx. One of the most important influences on prognosis is the presence of metastases to the cervical lymph nodes. Accurate determination of lymph node involvement is therefore a prerequisite for individualized therapy in patients with squamous cell carcinoma of the larynx and hypopharynx. Clinical palpation of the neck is not very accurate and the role of imaging techniques such as ultrasonography, ultrasound-guided fine needle aspiration cytology, colour Doppler ultrasound, computed tomography, magnetic resonance imaging and positron emission tomography is being applied in order to improve upon the results of clinical investigation alone.[16] Imaging the neck is unlike imaging any region of the torso or brain since maximal contrast resolution is necessary to differentiate lesions in cross-sectional exams of those solid organs. Because of the various organ systems, the neck has very good native contrast resolution between lesions and adjacent normal structures and at the interface with the skull base and thoracic inlet. Intravenous contrast is necessary, however, to differentiate veins (and arteries) from adenopathy and masses detection and staging of neck lesions are very important for accurate assignment of initial treatment pathways for individual patients.[17]

**Ultrasonography (USG);** USG has no role in evaluation of primary laryngeal and hypopharyngeal cancers. USG appears to be particularly useful in evaluation of neck nodes. In combination with FNAC, USG is the most accurate method for neck nodal staging in most head and neck cancers. It is also useful in differentiating solid from cystic mass lesions. An assessment can be made of the margins and texture of neck masses which may give information about the nature of palpated neck mass. USG appears to be particularly useful in evaluation of neck nodes. Doppler USG is flow sensitive and can be used to evaluate the neck vessels and relationship of masses to important vascular structures. It may also give information regarding the vascularity of neck masses.[18] Ultrasound is very sensitive in detecting metastatic involvement of the lower two-thirds of the internal jugular, spinal accessory, submental, and submandibular nodes. Its accuracy may exceed CT for detecting enlarged lymph nodes, but ultrasound does not reliably differentiate large reactive nodes from metastatic nodes. The upper one-third of the internal jugular, retropharyngeal, and tracheoesophageal groove nodes are poorly evaluated because of obscuration by bone or airway structures. Ultrasound may be the best method (possibly better than MRI or CT) for determining the presence of tumor invasion of the common or internal carotid artery and internal jugular vein by adjacent primary tumor or extracapsular spread from metastatic nodes. Invasion of the carotid artery is characterized by loss of the echogenic fascial plane between the vessel wall and the tumor.

**Computed Tomography (CT);** CT is the preferred imaging method of evaluation of laryngeal and hypopharyngeal cancers. In most cases, a dedicated CT study will provide all answers needed by the clinician; in such a setting, MRI is used as a complementary tool to solve remaining questions. The information that CT provides and which is difficult or impossible to obtain by the clinical evaluation alone is as follows: Pre-epiglottic space invasion, tongue base invasion, paraglottic space spread, laryngeal cartilage gross invasion, extralaryngeal and hypopharyngeal spread of tumor, subglottic spread, retrocricoid extension, tumor volume.[18] CT scan criteria for assessing nodal metastasis include; Increased size: > 1.5 cms for JD and submandibular lymphnodes, size > 1 cm for all cervical nodes and > 0.8 cm for retropharyngeal nodes in case of hypophyrangeal cancers, ill defined or irregular bordered mass,

central necrosis and node periphery is usually thick and enhance with contrast. Oblitration of fat lined around the carotid sheath is the sign of sheath infiltration.[18]

**Magnetic Resonance Imaging (MRI);** In many institutions MRI plays only a minor or no role in the evaluation of laryngeal and hypopharyngeal cancers. As MRI is a versatile technique, in selected indications this modality shows a benefit as compared with CT e.g. promising results are reported with diffusion weighted MRI in distinguishing radiotherapy induced tissue changes and tumor recurrences and for staging of neck lymph nodes.[18] Cross-sectional imaging will continue to develop computer assisted interactive methods for operative guidance and treatment based on pre-procedure scans. These procedures are best performed by practitioners with prior experience without the aid of imaging support. Further development of interactive types of software should allow trainees to develop skills on so-called virtual patients, providing that experience base. Performing procedures under imaging guidance is advancing from simple biopsies and ablations to real time guidance on "fluoroscopic-CT" and "open architecture" MRI equipment.[19]

**Nuclear Medicine;** Positron Emission Tomography (PET) is evolving and its exact role in imaging head and neck carcinoma is yet to be determined. Most of the available data are from retrospective studies, which involve limited numbers of patients. Nonetheless, PET has demonstrated great potential in this field.

**Staging**

***T-staging;*** Detection rate of a primary tumor in the setting of squamous cell carcinoma of the head and neck (SCCHN) with FDG-PET is slightly superior to MRI and CT and comparable to panendoscopy. For the superficial mucosal lesions, however, the limitations of all imaging modalities including PET are well recognized and panendoscopy remains the best way to evaluate such lesions. PET, because of limited spatial resolution and lack of anatomic detail, appears inappropriate for the assessment of submucosal extent of disease and involvement of adjacent structures. MRI and CT remain the modality of choice for this purpose. FDG-PET may identify a primary tumor that is not detected by other diagnostic modalities in the setting of cervical nodal metastasis with unknown primary, although false positive results are also frequent in this setting.

***N-staging;*** Sensitivity of FDG-PET in detection of metastatic lymph nodes in the neck is slightly higher than in other modalities. The impact of this increased sensitivity on patient management remains to be seen. A modality that would reliably differentiate N0 necks from N1 disease is very much needed, but it is unrealistic to expect PET to diagnose microscopic metastasis – even in the future – because of inherent technical limitations of spatial resolution. Currently available data do not justify the routine use of FDG-PET for nodal staging.

***M-staging;*** FDG-PET imaging is suitable for detection of distant disease because of its great sensitivity and ability to examine virtually the entire body in a single study. Synchronous lesions in the upper aerodigestive tract and lungs are also detected with FDG-PET more accurately than other modalities, although false positive results remain problematic.[20]

## MATERIALS AND METHODS

The present comparative study was conducted on newly diagnosed 25 patients with laryngeal and hypo pharyngeal malignancies over a period of one and a half year from April 2014 to September 2015, in the department of ENT and Head and Neck Surgery, SMHS Hospital, an associated hospital of Govt. Medical College, Srinagar. All newly diagnosed cases of malignancies of larynx and hypo pharynx were included during the period of the study. Recurrent/Residual cases of malignancies of larynx and Hypo pharynx (Post surgery ± chemo radiation) and Laryngeal or Hypo pharyngeal malignancy secondary to malignancy in the adjacent structures were excluded. All the patients under study were evaluated historically regarding their presenting complaints as per proforma attached. Their socio demographic profile (as per Kuppuswamy Scale) and associated risk factors were recorded. General physical and systemic examination findings were recorded as per proforma attached. General ENT clinical examination was done in all patients. Examination of neck was done in specific for recording features of palpable nodes, soft tissue extension and laryngeal crepitus. Telescopic Laryngoscopy ($70^0$ Hopkins Rod) assessment of all patients under study was done. Hypopharynx was particularly important to determine whether the cord is mobile or fixed, whether tumor is on the medial or lateral aspect of the pyriform sinus (number of walls involved), or whether the tumor extends across the midline when it involves the posterior pharyngeal wall. The larynx was also brought into complete view and photography was made of the extent of the lesion for future documentation. Cord mobility is best assessed as is assessment of the subglottic extent. The ventricle, false cord, anterior commissure and areas of supraglottis were thoroughly inspected and tumour extension outside the larynx was looked for – most commonly involved areas being the aryepiglottic fold into the pyriform fossa, the epiglottis into the valleculla and subglottis into the trachea. Baseline Investigations as per Performa. FNAC of largest palpable clinical node. Pulmonary function tests was done in those patients planned for surgery. Radiological assessment was done by; USG for recording size, number, level of neck nodes which fulfill features of metastatic nodes were recorded in all patients. USG guided FNAC of upstaged nodes. USG abdomen for distant metastasis, CECT Neck for recording primary site of involvement with extensions and metastatic nodes (if any) in all patients and CEMRI (where ever needed). Tumour class, nodal class, distant metastatic class and staging were recorded both clinically and clinico radiologically as per AJCC 2010. Tumor classification of larynx and hypopharynx according to TNM AJCC 2010.[21] Direct laryngoscopic ± hypopharyngoscopic examination with biopsy was done. Statistical analysis was done using appropriate tests. Treatment was advised on the basis of clinico-radiological stage in accordance with the NCCN Guidelines Version 2, 2013.

## OBSERVATION AND RESULTS

In present study 10 (40%) patients were of 61-70 years of age followed by 7 (28%) patients who belong to 51-60 year age group. There were 4 (16%) each patient in 41-50 and 71-80 years of age groups. Regarding gender, 23 (92%) were male patients and only 2 (8%) were females. Out of a total of 25 patients, 21 (84%) were rural residents and only 4 (16%) patients belonged to urban areas. 17 (68%) patients were skilled workers, followed by 3 (12%) patients each as unemployed and unskilled workers and only 2 (8%) patients were professionals. Socioeconomic status of patients calculated by Kuppuswamy scale showed 9 (36%) patients belonged to class IV, 8 (32%) patients belonged to class III, 4 (16%) patients belonged to class II, 3 (12%) patients belonged to class V and only 1 patient (4%) belonged to socioeconomic class I. In current study, out of a total of 25 patients studied, 15 (60%) patients were smokers, 3 (12%) patients were having fungicide/ pesticide exposure and 2 (8%) patients were alcoholics. 3 (12%) patients were having fungicide/ pesticide exposure + were also smokers, 1 (4%) patient was alcoholic + smoker and another 1 (4%) patient had

cement dust exposure + was also a smoker. Present study showed that 13 (52%) of our patients had change of voice as the presenting complaint followed by stridor in 6 (24%) patients. There were 5 (20%) patients with Odynophagia and 5 (20%) patients with neck mass followed by 4 (16%) with Otalgia and 4 (16%) with weight loss. (Table1)

**Table 1: Socio demographic Profile, Risk factors and Chief Complaints**

| | | No. of Patients (N=25) | Percentage (%) |
|---|---|---|---|
| **Age (years)** | <40 | 00 | 00 |
| | 41-50 | 04 | 16 |
| | 51-60 | 07 | 28 |
| | 61-70 | 10 | 40 |
| | 71-80 | 04 | 16 |
| | >80 | 00 | 00 |
| **Gender** | Males | 23 | 92 |
| | Females | 2 | 8 |
| **Dwelling** | Rural | 21 | 84 |
| | Urban | 4 | 16 |
| **Occupation** | Unemployed | 03 | 12 |
| | Unskilled | 03 | 12 |
| | Semiskilled | 00 | 00 |
| | Skilled (Shop-Owner/ Farmer/Orchard owner) | 17 | 68 |
| | Semi-professional | 00 | 00 |
| | Professional | 02 | 08 |
| **SES** | I | 01 | 04 |
| | II | 04 | 16 |
| | III | 08 | 32 |
| | IV | 09 | 36 |
| | V | 03 | 12 |
| **Risk Factor** | Smoker | 15 | 60 |
| | Fungicide/pesticide exposure | 03 | 12 |
| | Fungicide/pesticide exposure+ Smoker | 03 | 12 |
| | Alcoholic | 02 | 08 |
| | Alcoholic + Smoker | 01 | 04 |
| | Cement dust exposure + Smoker | 01 | 04 |
| **Complaints** | Change of voice | 13 | 52 |
| | Stridor | 06 | 24 |
| | Odynophagia | 05 | 20 |
| | Neck mass | 05 | 20 |
| | Otalgia | 04 | 16 |
| | Weight loss | 04 | 16 |

Out of a total of 25 patients, 12 (48%) patients had glottic malignancy as primary site of involvement, 8 (32%) patients had supra-glottic malignancy [non-marginal in 5 (2%) patients and marginal in 3 (12%) patients] and 5 (20%) patient had hypopharyngeal malignancy [4 (80%) had pyriform sinus and 1 (20%) patient had posterior pharyngeal wall] as primary site of involvement . No primary subglottic or post cricoid malignancy was observed in our study. $70^0$ endoscopic findings [n=25], depicts that in our study, 8 (32%) patients had vocal cord fixation, 7 (28%) patients had impaired cord mobility, 5 (20%) patients had pooling of secretions in pyriform sinus, 4 (16%) patients had anterior commissure involvement and another 4 (16%) patients had subglottic extension. There were 2 patients (8%) with false cord involvement and only 1 (4%) patient with fixed hemilarynx.

Out of a total of 25 patients, there were 12 (48%) patients with glottic malignancy out of which 7 (58.33%) belonged to T2 and 5 (41.67%) belonged to T3 class. There were 8 (32%) patients with supraglottic malignancy out of which 6 (75%) belonged to T2 and 2 (25%) belonged to T3 class. Out of 5 (20%) patients with Hypopharyngeal malignancy 4 (80%) patients belonged to T2 and 1 (20%) patient belonged to T3 class. (Table 2)

**Table 2: Clinical T- class of tumor (Endoscopic $70^0$ + D/L Findings)**

| Clinical T- class of tumor (Endoscopic $70^0$ + D/L Findings) | | | | | |
|---|---|---|---|---|---|
| Site Involved | T Class of Tumors | | | | Total |
| | T1 | T2 | T3 | T4 | |
| Glottic | 00 | 07 | 05 | 00 | 12 |
| Supraglottic | 00 | 06 | 02 | 00 | 08 |
| Subglottic | 00 | 00 | 00 | 00 | 00 |
| Hypopharngeal | 00 | 04 | 01 | 00 | 05 |
| Total | 00 | 17 | 08 | 00 | 25 |

Out of 25 patients under study 11 patients had clinically palpable nodes. Out of 12 (48%) patients with glottic malignancy 9 patients (75%) belonged to N0, 2 patients (16.67%) belonged to N1 and 1 patient (8.33%) belonged to N3 class. Out of 8 (32%) patients with supraglottic malignancy 4 patients (50%) belonged to N0, 3 patients (37.50%) belonged to N1 and 1 patient (12.5%) belonged to N2 class. Out of 5 (20%) patients with Hypopharyngeal malignancies 1 patient (20%) belonged to N0, and 4 patients (80%) belonged to N1 class. (Table 3)

**Table 3: Clinical N-class of Tumor**

| Clinical N-class of Tumor | | | | | |
|---|---|---|---|---|---|
| Site Involved | N Class of Tumors | | | | Total |
| | N0 | N1 | N2 | N3 | |
| Glottic | 9 | 02 | 00 | 01 | 12 |
| Supraglottic | 04 | 03 | 01 | 00 | 08 |
| Subglottic | 00 | 00 | 00 | 00 | 00 |
| Hypopharngeal | 01 | 04 | 00 | 00 | 05 |
| Total | 14 | 09 | 01 | 01 | 25 |

According to TNM Staging our results were; Stage II includes**;** 6 cases of T2 N0 – Glottic malignancy, 3 cases of T2 N0 – Supraglottic malignancy,1 case of T2N0 – Hypopharyngeal malignancy.

Stage III includes**;** 3 cases of T3 N0, 1case of T2 N1, and 1 case of T3N1 – Glottic malignancy, 1 case of T3N0, 3 cases of T2N1, – Supraglottic malignancy**,** 3 cases of T2N1, 1 case of T3N1 – Hypopharyngeal malicnancy

Stage IV includes**;** 1 case of T3N3 – Glottic malignancy,1 case of T3 N2 – Supraglottic malignancy.

Out of a total of 25 patients, after radiological evaluation there were 12 (48%) glottic malignancies in which 6 (50%) patients each belonged to T2 and T3 class. There were 8 (32%) patients with supraglottic malignancies in which 2 (25%) patients belonged to T2, 5 (62.5%) patients belonged to T3 and 1 (12.5%) belonged to T4 class. Out of 5 (20%) patients with Hypopharyngeal malignancies 4 (80%) patients belonged to T2 and 1 (20%) patient belonged to T4 class. Thus in comparison of Table no. 2, after clinico-radiological evaluation, 1 patient of glottic carcinoma was upstaged from T2 to T3 lesion, 4 patients of supraglottic carcinoma were upstaged from T2 to T3 lesion and 1 patient was of supraglottic carcinoma was upstaged from T3 to T4 lesion. 1 patient of hypopharyngeal carcinoma was upstaged from T3 to T4 lesion.

Out of 25 patients under study 11 patients (44%) had metastatic nodes. After radiological evaluation out of 12 (48%) patients with glottic malignancies 9 (75%) patients were N0, 1 (8.33%) patient each had N1, N2 (b) and N3 nodal class. Out of 8 (32%) patients with supraglottic malignancies 4 (50%) patients were N0, 2 (25%) patients each had N1 and N2(c) nodal class. Out of 5 (20%) patients with hypo pharyngeal malignancy 1 (20%) patient each belonged to N0 and N1 nodal class, and 3 (60%) patients belonged to N2 nodal class [1 to N2 (a),1 to N(2b) and 1 to N 2(c)]. Bilateral nodal involvement was seen in 3 (27.27%) node positive patients, out of which 2 patients had supraglottic malignancy and 1 patient had hypopharyngeal malignancy. Thus in comparison of Table 3, after radiological evaluation 1 patient of glottic carcinoma with N1 nodal class was upstaged to N2b , 1 patient of supraglottic with N1 nodal class was upstaged to N2c nodal class and 3 patients of hypopharyngeal carcinoma with N1 nodal class were upstaged with 1 patient each to N2a , N2b and N2c nodal class. Lymph nodes involvement according to the T-class of tumors in our study we observed that, most number of cases with nodal metastases in our study were in $T_3$ lesions i.e. 5 patients (45.4%), followed by $T_2$ lesion i.e. 4 patients (36.4%) and $T_4$ lesion i.e. 2 patients (18.2%). In our study neck node metastases were seen in 11 patients out of total 25 cases. Maximum number of metastatic lymph nodes were present at level III in 4 (36.36 %) patients, followed by level II in 4 (36.36 %) patients, level IV in 2 (18.18%) patients and level V in 1 (9%) patient respectively. No lymph node metastases in level I and level VI was observed and also no contralateral node was observed in our study. Most number of cases with nodal metastases in our study were in $T_3$ lesions i.e. 5 patients (45.4%), followed by $T_2$ lesion i.e. 4 patients (36.4%) and $T_4$ lesion i.e. 2 patients (18.2%).

Study observations regarding clinico- radiological are shown in Table 4.

**Table 4: Clinico-radiological stage of patients with larynx and hypopharynx malignancy**

| Clinico-radiological stage of patients with larynx and hypopharynx malignancy [n=25] | | |
|---|---|---|
| Clinico-radiological Stage (TNM) | No. of Cases | Percentage |
| I | 00 | 00 |
| II | 08 | 32 |
| III | 08 | 32 |
| IV | 09 | 36 |

Stage II includes**:** 5 cases of T2 N0 – Glottic malignancy, 2 cases of T2 N0 – Supraglottic malignancy,1 case of T2N0 – Hypopharyngeal malignancy;

Stage III includes: 4 cases of T3 N0 – Glottic malignancy, 2 cases T3 N0, and 1 case of T3 N1 –Supraglottic malignancy**,** 1 case of T2 N1 – Hypopharyngeal malignancy

Stage IV includes: 1 case of T2 N2b M0; 1 of T3 N3 M0; 1 of T3 N1 M1 (lung apices nodules) –Glottic malignancy, 2 cases of T3 N2c, M0; 1 case of T4a N1 M0 (tongue base involvement) – Supraglottic malignancy, 1 case of T2N2a M0; 1 case of T2N2c M0; 1 case of T4b N2b M0 (Prevertebral space involvement) – Hypopharyngeal malignancy.

Comparison of clinical T-class with clinico-radiological in T class are shown in Table 5.

**Table 5: Comparison of T-class [n=25] (Clinical: Clinico- radiological)**

| Comparison of T-class [n=25] (Clinical : Clinico- radiological) | | | | |
|---|---|---|---|---|
| Class | Clinical T-class | | Clinico-Radiological T-class | |
| | No. | % | No. | % |
| T1 | 00 | 00 | 00 | 00 |
| T2 | 17 | 68 | 12 | 48 |
| T3 | 08 | 32 | 11 | 44 |
| T4 | 00 | 00 | 02 | 08 |

There were 17 (68%) patients and 12 (48%) patients of T2 class diagnosed clinically and clinico-radiologically respectively. There were 8 (32%) patients and 11 (44%) patients of T3 class diagnosed clinically and clinico-radiologically respectively. 2 (8%) patients of T4 class were diagnosed clinico-radiologically alone. The results observed are statistically not significant (p value 0.189).

Present study also showed that there were 14 (56%) patients each diagnosed clinically and radiologically with N0 nodal class. 9 (36%) patients were diagnosed clinically with N1 nodal class where only 4 (16%) were diagnosed radiologically with N1 nodal class. In patients with N2 nodal class, 1 (4%) was diagnosed clinically and 6 (24%) were diagnosed radiologically. The only 1 (4%) patients with N3 nodal class was diagnosed both clinically and radiologically.

Observations regarding Comparison of Clinical Tumor Staging with Clinico- Radiological Tumor Staging are shown in Table 6.

**Table 6: Comparison of Clinical Tumor Staging with Clinico- Radiological Tumor Staging**

| Comparison of Clinical Tumor Staging with Clinico- Radiological Tumor Staging | | | |
|---|---|---|---|
| Clinical Staging | | Clinco-Radiological Staging | |
| **No.** | **Percentage** | **No.** | **Percentage** |
| 00 | 00 | 00 | 00 |
| 10 | 40 | 08 | 32 |
| 13 | 52 | 08 | 32 |
| 02 | 08 | 09 | 36 |

The above table shows the comparison of clinical tumor staging with clinic-radiological tumor staging of the patients under study. We observed that there were 10 (40%) patients in stage II clinically and after radiological evaluation only 8 (32%) patients belonged to stage II while as remaining 2 (8%) patients were upstaged to stage IV. There were 13 (52%) patients in stage III clinically and after radiological evaluation 8 (32%) patients were in stage III while as remaining 5 (38.46%) patients were upstaged to stage IV. There were 2 (8%) patients in stage IV clinically and after radiological evaluation 9 (36%) patients were recorded in stage IV. Overall there were 7 patients (28%) who were upstaged which included 2 patients (8%) from stage II and 5 patients (20%) from stage III.

Additional information provided by the imaging (USG,CECT ± CEMRI), we observed on CECT that, 7 (28%) patients had thyroid cartilage involvement (2 (28.57%) patients were having invasion and 5 (71.43%) patients had erosion), 6 (24%) patients had anterior commissure involvement, 6 (24%) patients with subglottic extension 4 (16%) patients had paraglottic fat involvement, 3 (12%) patients had pre-epiglottic space extension, pre- vertebral space involvement [stage IVb] and only 1 (4%) patient had distant metastasis to lung apices [stage IVc] . On CEMRI 1 (4%) patient was diagnosed with tongue base involvement [stage IVa]. On both USG and CECT, 5 (20%) patients were diagnosed with metastatic nodal involvement, 3 patients had bilateral i.e (N2c) and 2 patients had multiple ipsilateral i.e (N2b) nodal class, among these 5 patients, [4 patients upstaged to IVa and 1 patient upstage to IVb]. The tumor invasion into these areas, changed the final staging of tumor which in turn change the primary treatment modality.

Histopathological examination with all 25 (100%) patients showed squamous cell carcinoma.

Out of total of 25 patients of laryngeal and hypopharyngeal malignancies it was found that, there were 4 (16%) patients with well differentiated squamous cell carcinoma; 10 (40%) patients moderately differentiated squamous cell carcinoma, 9 (36%) patients with poorly differentiated squamous cell carcinoma and 2 (8%) patients with undifferentiated squamous cell carcinoma.

**Table 7: Treatment Advised as Per NCCN Guidelines Version 2.2013**

| TNM Staging | Primary Site of Malignancy | Malignancy Stage | No. of Patients | Treatment Advised as per NCCN Guidelines Version 2.2013 |
|---|---|---|---|---|
| T2 N0 M0 | Glottic | II | 5 | RT or Surgery (Partial laryngectomy/endoscopic or open). |
| T2 N0 M0 | Supraglottic | II | 2 | Endoscopic resection ± ND or Surgery (Open Partial SupraglotticLaryngectomy ± ND) OR Radiotherapy. |
| T2 N0 M0 | Hypopharyngeal | II | 1 | Radiotherapy or Surgery (Partial Laryngopharyngectomy/ open or endoscopic ± ND). |
| T3 N0 M0 | Glottic | III | 4 | Concurrent CT/ RT or RT (if pt is not fit for CT) or Surgery [Total Laryngectomy with ips.thyroidectomy + ND (UL or BL)]. |
| T3 N0 M0 | Supraglottic | III | 2 | Concurrent CT/ RT or Surgery [Total Laryngectomy with ips.thyroidectomy + ND (UL or BL)] or RT (if pt is not fit for CT). |
| T3 N1 M0 | Supraglottic | III | 1 | Concurrent CT/RT or RT or Partial Supraglottic laryngectomy and neck dissection(s) or Induction chemotherapy |
| T2 N1 M0 | Hypopharyngeal | III | 1 | Induction CT or Surgery (Laryngopharyngectomy + ND) or Concurrent CT/RT. |
| T2 N(2b) M0 | Glottic | IVa | 1 | RT or Surgery (Partial laryngectomy open/endoscopic + ND). |
| T3 N3 M0 | Glottic | IVb | 1 | Concurrent CT/ RT or Surgery [Total Laryngectomy with ips.thyroidectomy + ND (UL or BL)]. |
| T3 N1 M1 | Glottic | IVc | 1 | Concurrent CT/RT for palliation. |
| T3 N(2c) M0 | Supraglottic | IVa | 2 | Concurrent CT/ RT or Surgery [Total Laryngectomy with ips.thyroidectomy + ND (UL or BL)] or Induction CT. |
| T4a N1 M0 | Supraglottic | IVa | 1 | Surgery [Total Laryngectomy with ips.thyroidectomy + ND (UL or BL)] or Concurrent CT/RT (Patients who refuse surgery). |
| T2 N(2a) M0 | Hypopharyngeal | IVa | 1 | Induction CT or Surgery (Laryngopharyngectomy + ND) or Concurrent CT/RT. |

| | | | | |
|---|---|---|---|---|
| T2 N(2b) M0 | Hypopharyngeal | IVa | 1 | Induction CT or Surgery (Laryngopharyngectomy + ND) or Concurrent CT/RT. |
| T4b N(2c) M0 | Hypopharyngeal | IVb | 1 | Surgery preferred when resectable (Total laryngectomy with partial pharyngectomy with ND) or induction chemotherapy or concurrent CT/RT. |

The above table shows that in our study out of total of 25 patients of laryngeal and hypopharyngeal malignancies, 16 (64%) patients were treated by radiotherapy or concurrent chemoradiation, 4 (16%) patients were treated by total laryngectomy with neck dissection and 3 (12%) patient were treated by total laryngectomy with partial pharyngectomy with neck dissection and 2 (8%) patients were treated by total laryngectomy alone. Treatment advised was according to the clinico-radiological staging of the patients as per the NCCN GUIDELINES Version 2.2013.

**DISCUSSION**

The clinico-endoscopic examination alone often fails to identify tumor invasion of the laryngeal cartilages and of the extra laryngeal soft tissue, thus resulting in low staging accuracy. Combination of clinico - endoscopic evaluation and an additional radiological evaluation by (USG, CECT ± CEMRI Imaging) result in significantly improved staging accuracy and thus change the primary modality of treatment. [22] Present study was conducted in department of ENT and HNS in SMHS Hospital, an associated hospital of Government Medical College Srinagar and comprised total of 25 cases of laryngeal and hypo pharyngeal malignancies all of whom underwent the clinco-endoscopic examination followed by radiological evaluation (USG, CECT ± CEMRI) for the pretherapeutic staging and henceforth the appropriate treatment. In present study maximum number of patients were males 23 (92%) and only 2 (8%) were female patients with male to female ratio as 11.5: 1. Maximum number of patients was in the age group of > 50 years of life (84%) with mean age being 54.4 years. The youngest patient in our study was aged 48 years and oldest patient was aged 80 years. Paymaster *et al* (1963) reported in a similar study that 85% of head and neck cancer patients were males, and only 15% as females.[23] Eisbach KJ *et al* (1977) reported that in hypo pharyngeal malignancies mean age of presentation was 60 years.[6] Zoller *et al* (1978) in their study had reported mean age for the head and neck malignancies as 59.5 years.[24] Driscoll *et al* (1983) reported the peak incidence of hypopharyngeal carcinoma as 60 years.[25] Koufman and Burke (1997) stated that most patients who developed laryngeal squamous cell carcinoma were males and overall male female ratio was 5:1.[26] Varsha Joshi *et al* (2014) reported that the mean age of laryngeal carcinoma is between 50 and 70 years.[27] Thus age and sex distribution in our study was close to the observations of above reported studies**.** Smoking, alcohol and some occupation related exposures have been implicated as an important etiological agent in the development of head and neck cancers as well as cancers elsewhere in the aerodigestive tract. In our study out of a total of 25 patients studied, 15 (60%) patients were smokers, 3 (12%) patients were having fungicide/ pesticide exposure and 2 (8%) patients were alcoholics. 3 (12 %) patients were having fungicide/ pesticide exposure + were also smokers, 1(4%) patient was alcoholic + smoker and another 1 (4%) patient had cement dust exposure + was also a smoker. Jesse *et al* (1981) observed in their study that 85% patients with head and neck cancer were smokers. Elwood JM *et al* (1984) reported that tobacco and alcohol act synergistically to increase the risk of cancer.[28] Relative contribution of alcohol and tobacco varies by site. Alcohol consumption is more important risk factor for supraglottic (85-90%) and hypopharyngeal (83%) carcinomas where as tobacco use is strongly associated with glottic carcinomas (90-95 %). Oslen J *et al* (1984) reported that cement dust exposure was a risk factor for laryngeal cancer.[29] Jayant *et al* (1986) have shown that smoking is a stronger risk factor for the development of laryngeal cancer than chewing tobacco, the relative risk being 11.8 fold and 7.7 fold respectively with reverse being the case for squamous cell carcinoma of the hypopharynx.[30] De Stefani *et al* (1987) found that 97.2% patients with laryngeal squamous cell carcinoma were smokers.[31] Paquerette Goldberg *et al* (1997) observed that there was an excess risk of laryngeal and hypopharyngeal cancer among the agricultural workers (OR 1.6, 95 % CI 0.9 to 2.8).[32] Eduardo De Stefani *et al* (1998) studied the effects of type of employment and substance present in the workplace on laryngeal cancer risk and observed strong inorganic acids and pesticide exposures was associated with increased risk of laryngeal cancer.[33] Wesseling C *et al* (1999) finds heavy pesticide use in rular areas which was associated with an increase risk of laryngeal cancer in males.[34] All the Risk factors reported in the above quoted studies were also observed in our study.

Our study results showed that 13 (52%) patients had change of voice as the chief complaint followed by stridor in 6 (24%) patients. There were 5 (20%) patients with Odynophagia and 5 (20%) patients with neck mass followed by 4 (16%) patients with Otalgia and 4 (16%) patients with weight loss. Garas J *et al* (2006) reported patients with cancers of larynx and hypopharynx usually present with symptoms of hoarseness of voice, odynophagia, stridor, otalgia, neck mass or weight loss.[35] Mackenzie K *et al* (2009) reported that patients of laryngeal and hypopharyngeal malignancies commonly present with the complaints of hoarseness (glottic), as the tumor volume increases, less of the laryngeal airway remains patent and stridor ensues.[2] Associated symptoms may include odynophagia, otalgia, weight loss, and/or neck mass. American cancer society (2013) reported that glottic cancers have the hoarseness or change in the voice as the primary presentation.[36] For cancers that start from above the vocal cords (supraglottis) or hypopharynx do not usually cause voice changes and may present late with symptoms like pain on swallowing (odynophagia), trouble breathing (stridor), ear pain (otalgia), or mass in the neck. Hence presentations of chief complaint of patients in our study were quite similar to those observed in the above mentioned studies. In our study out of a total of 25 patients, 12 (48%) patients had glottic malignancy as primary site of involvement, 8 (32%) patients had supra-glottic malignancy [non-marginal in 5 (2%) patients and marginal in 3 (12%) patients] and 5 (20%) patient had hypopharyngeal malignancy [4 (80%) had pyriform sinus and 1 (20%) patient had posterior pharyngeal wall] as primary site of involvement. No primary subglottic or post cricoid malignancy was observed in our study. Eisbach KJ *et al* (1977) reported that in hypopharyngeal malignancies pyriform sinus comprise 66-75%, posterior pharyngeal wall 20-25% and postcricoid region > 10% in United states and the figures in Europe and Northern Europe are 60% pyriform sinus, 20-25% posterior pharyngeal wall and > 15 % postcricoid region.[6] Jonas A. Castelijn's *et al* (1987) stated that general range of incidence of glottic carcinoma in United States is 60-70%, supraglottic 25-35% and subglottic 5%.[37] P.D. Phelps *et al* (1992) found supraglottic carcinoma comprising about 30% of laryngeal cancers.[38] American cancer society (2013) reported that About 60 per cent of larynx cancers

start in the glottis, 35 per cent develop in the supraglottic region and the remaining 5 per cent occur in the subglottis.[36] Distribution of cases according to various sites of larynx and hypopharynx almost match with observations of the above studies particularly with respect to supraglottic and hypopharyngeal malignancies, slight difference in percentage of glottic malignancies can be explained by small sample size of glottic cancers in our study**.**

In present study on pre-operative examination with the angled endoscope (70 degree Hopkin rod) we observed that 8 (32%) patients had vocal cord fixation, 7 (28%) patients had impaired cord mobility, 5 (20%) patients had pooling of secretions in pyriform sinus, 4 (16%) patients had anterior commissure involvement and another 4 (16%) patients had subglottic extension. There were 2 (8%) patients with false cord involvement and only 1 (4%) patient with fixed hemilarynx. Fenton *et al* (1995) observed that endoscopic assessment of the hypopharynx is particularly important to determine whether the cord is mobile or fixed, whether tumor is on the medial or lateral aspect of the pyriform sinus (number of walls involved), or whether the tumor extends across the midline when it involves the posterior pharyngeal wall.[39] The larynx is also brought into complete view and photography is made of the extent of the lesion for future documentation. Cord mobility is best assessed as is assessment of the subglottic extent .The ventricle, false cord, anterior commissure and areas of supraglottis are thoroughly inspected and tumor extension outside the larynx is then described – most commonly involved areas being the aryepiglottic fold into the pyriform fossa, the epiglottis into the valleculla and subglottis into the trachea. In our study also $70^0$ endoscopic examinations proved beneficial in preoperative assessment of laryngeal and hypopharyngeal malignancies especially with respect to vocal cord movement, tumor localization and photographic documentation of extension of lesion for future reference**.**

Comparison of clinical T-class with clinico-radiological T class was done in our study. We observed that there were 17 (68%) patients and 12 (48%) patients of T2 class diagnosed clinically and clinico-radiologically respectively. There were 8 (32%) patients and 11 (44%) patients of T3 class diagnosed clinically and clinico-radiologically respectively. 2 (8%) patients of T4 class were diagnosed clinico-radiologically alone. Thus after clinico-radiological evaluation, 1 patient of glottic carcinoma was upstaged from T2 to T3 lesion , 4 patients of supraglottic carcinoma were upstaged from T2 to T3 lesion and 1 patient was of supraglottic carcinoma was upstaged from T3 to T4 lesion. 1 patient of hypopharyngeal carcinoma was upstaged from T3 to T4 lesion. In our study on comparison of clinical nodal N-class with clinico-radiological nodal N- class was done. It was observed that there were 14 (56%) patients each diagnosed clinically and radiologically with N0 nodal class. 9 (36%) patients were diagnosed clinically with N1 nodal class whereas only 4 (16%) patients were diagnosed radiologically with N1 nodal class. In patients with N2 nodal class, only 1 (4%) patient was diagnosed clinically and 6 (24%) patients were diagnosed radiologically. The only 1 (4%) patient with N3 nodal class was diagnosed both clinically and radiologically.

Regarding distribution of Lymph node metastases according to the primary site of malignancy clinico-radiologically present study showed that out of 25 patients under study 11 patients (44%) had metastatic nodes. After radiological evaluation out of 12 (48%) patients with glottic malignancies 9 (75%) patients were N0, 1 (8.33%) patient each had N1, N2(b) and N3 nodal class. Out of 8 (32%) patients with supraglottic malignancies 4 (50%) patients were N0, 2 (25%) patients each had N1 and N2(c) nodal class. Out of 5 (20%) patients were with hypopharyngeal malignancy among which 1 (20%) patient each belonged to N0 and N1 nodal class, and 3 (60%) patients belonged to N2 [1 to N2(a),1 to N(2b) and 1 to N 2(c)] nodal class. Bilateral nodal involvement was seen in 3 (27.27%) node positive patients, out of which 2 patients had supraglottic malignancy and 1 patient had hypopharyngeal malignancy.
Thus after radiological evaluation 1 patient of glottic carcinoma with N1 nodal class was upstaged to N2b, 1 patient of supraglottic with N1 nodal class was upstaged to N2c nodal class and 3 patients of hypopharyngeal carcinoma with N1 nodal class were upstaged with 1 patient each to N2a , N2b and N2c nodal class. De Santo *et al* (1977) in their study observed following incidence for supraglottic carcinoma $N_0$ 61%, $N_2$ 33%.[40] Buckley JG *et al* (2000) in their study reported that 80% of the patients with hypopharyngeal malignancies have local lymph nodes palpable on physical examination or detected by imaging at first presentation.[41] In hypopharyngeal cancers because of the advanced stage at presentation and its involvement or extension to cross the midline, the risk of contralateral metastasis is high on more than 20% of cases treated surgically. In the same study they also observed that bilateral metastasis (palpable or occult) occur more frequently in supraglottic carcinomas and are more common in midline or bilateral tumors. Ferlito *et al* (2011) in their study found that the lymph node metastases as: Glottic carcinoma: $N_0$ 70%, $N_1$ 20%, $N_{2\text{-}3}$ 10%; Supraglottic carcinoma: $N_0$ 49%, $N_1$ 18%, $N_{2\text{-}3}$ 33%; Hypopharyngeal carcinoma: $N_0$ 22%, $N_1$ 21%,$N_{2\text{-}3}$ 57%. [42] Erkan Karatas *et al* (2012) in their study reported the neck metastasis was rare in $T_1$ and $T_2$ glottic tumors , while there was a significant increase in the rate of $N^+$ neck (35%) in $T_3$ and $T_4$ glottic tumors ($p < 0.05$).[43] The results of our study are almost in close approximation with the above mentioned studies**.**

In this study neck node metastases were seen in 11 patients out of total 25 cases. Maximum number of metastatic lymph nodes were present at level III in 4 (36.36 %) patients, followed by level II in 4 (36.36 %) patients, level IV in 2 (18.18%) patients and level V in 1 (9%) patient respectively. No lymph node metastases in level I and level VI was observed and also no contralateral node was observed in our study. Lindberg (1972) observed that maximum spread of metastases from carcinoma of larynx and upper digestive tract is along the jugular chain and upper jugular nodes are most commonly affected.[44] Shah JP *et al* (1990) found that level II, III and IV to be at greatest risk for nodal metastases from cancer of oropharynx, hypopharynx and larynx.[13] Yoau P Talmi *et al* (1998) in a study of 39 cases of head and neck cancer found level II as most commonly involved (79%) site.[45] Werner JA (2007) observed that laryngeal carcinoma mostly metastasize in level II and III lymph nodes.[46] Our results are in close proximity with the results of above mentioned studies. Incidence of bilateral nodal involvement was seen in 3 (27.27%) node positive patients, out of which 2 patients had supraglottic malignancy and 1 patient had hypopharyngeal malignancy. Marks *et al* (1992) in their study observed that risk of bilateral metastases on presentation or during follow up were greatest for supraglottic cancer (26%).[47] Kowalski and Medina (1998) in their study stated that bilateral or isolated contralateral metastasis is less frequent varying from < 2% to upto 35%. In 223 cases of head and neck cancer patients with cervical node metastases they observed that ipsilateral metastases was present in 81.6% and bilateral metastasis in 16.4% and contralateral metastases is 2.24%. [48] Aluffi P *et al* (2006) in their study reported that in hypopharyngeal cancers, because of the advanced stage at presentation and its extension across the midline, the risk of contralateral metastasis is high on more than 20% of cases treated surgically. [49] Varsha M Joshi *et al* (2014) reported that

nodal staging is the most accurate prognostic factor for SCC. Unilateral nodal disease indicates a 50% reduction in long term survival while a bilateral nodal involvement indicates a 75% reduction.[50] Additionally, extra nodal spread increases the risk of treatment failure and increases the risk of recurrence and reduces the survival by 50%. Involvement of bilateral nodal metastases observed in our study almost match with the observations of Kowalski and Medina and Marks et al for supraglottic malignancy. Most number of cases with nodal metastases in our study were in $T_3$ lesions i.e. 5 patients (45.4%), followed by $T_2$ lesion i.e. 4 patients (36.4%) and $T_4$ lesion i.e. 2 patients (18.2%). Mittal B, Mark J.E, Ogura JH (1984) observed that the incidence of clinically positive lymph adenopathy increased with advancing T-stage. In their study, metastases were 15% in $T_2$ lesions, 25% in $T_3$ and 40% in $T_4$ lesions of larynx.[51] The results in our study differ with the observations of above study. The possible reason may be low sample size in our study. In present study the comparison of clinical tumor staging with clinico-radiological tumor staging of the patients under study was done. It was observed that there were 10 (40%) patients in stage II clinically and after radiological evaluation only 8 (32%) patients belonged to stage II while as remaining 2 (8%) patients were upstaged to stage IV. There were 13 (52%) patients in stage III clinically and after radiological evaluation 8 (32%) patients were in stage III while as remaining 5 (38.46%) patients were upstaged to stage IV. There were 2 (8%) patients in stage IV clinically and after radiological evaluation 9 (36%) patients were recorded in stage IV. Overall there were 7 patients (28%) who were upstaged who included 2 patients (8%) from stage II and 5 patients (20%) from stage III. The result observed on comparison was statistically significant (p-value 0.025).

The additional information provided by the imaging (USG,CECT ± CEMRI); we found on CECT that 7 (28%) patients had thyroid cartilage involvement (2 (28.57%) patients were having invasion and 5 (71.43%) patients had erosion), 6 (24%) patients had anterior commissure involvement, 6 (24%) patients with subglottic extension 4 (16%) patients had paraglottic fat involvement, 3 (12%) patients had pre-epiglottic space extension, pre- vertebral space involvement [stage IVb] and only 1 (4%) patient had distant metastasis to lung apices [stage IVc] . On CEMRI 1 (4%) patient was diagnosed with tongue base involvement [stage IVa]. On both USG and CECT, 5 (20%) patients were diagnosed with metastatic nodal involvement, 3 patients had bilateral i.e. (N2c) and 2 patients had multiple ipsilateral i.e. (N2b) nodal class, among these 5 patients, [4 patients upstaged to IVa and 1 patient upstage to IVb]. The tumor invasion into these areas, changed the final staging of tumor which in turn change the primary treatment modality. Parsons CA *et al* (1980) found that CT provided an additional preoperative information like better delineation of submucosal tumour extent, invasion of pre-epiglottic space and cartilage displacement or invasion.[52] Mark Scott *et al* (1981) found that the information concerning the thyroid, arytenoids and cricoid cartilages, and as well as the anterior commissure and conus elasticus is critical for treatment planning. Thus if conservative surgery is contemplated CT of the larynx is essential. [53] Gerristen GJ *et al* (1986) reported that CT represents CT represents the only method capable for visualizing the extent of laryngeal cancer in the horizontal plane.[54] It is of particular value in the visualization of pre-epiglottic space, the thyroid cartilages and the extra laryngeal soft tissues. Phelps PD (1992) found that pre-epiglottic space invasion is a feature in the majority of supraglottic infrahyoid carcinomas and for these $T_3$ and $T_4$ lesions imaging confirmation may assist the decision to perform total laryngectomy as the primary procedure.[38] Peter Zbaren *et al* (1996) found Cartilage involvement in 32 (80.0%) patients, Anterior commissure involvement in 29 (72.5%) patients , Subglottic area involvement in 27 (67.5%) patients, Paraglottic space involvement in 29 (72.5%) patients and Pre-epiglottic space involvement in 9 (22.5 %).[22] Deviations in present study from the study of the above authors could be due to low sample size in this study.

Bardley A *et al* (1990) in their study reported that supraglottic tumors may also cephalad within the pre-epiglottic space to invade the tongue base without distorting the mucosa of the vallecullae.[55] Dullerud R *et al* (1992) found that CT did not change the classification for $T_1$ and $T_2$ glottic tumors. They concluded that CT is manadatory only in advanced tumors of glottic region or when the anterior commissure is involved.[56] Hassan M, Thabet *et al* (1996) found that clinical staging of laryngeal tumors showed high accuracy in staging of glottic tumors especially $T_1$ and $T_2$ glottic tumors, low accuracy in staging supraglottic tumors, very low accuracy in staging transglottic tumors. The CT staging showed high accuracy in staging transglottic and supraglottic tumors in comparison with clinical staging.[57] Loevner LA *et al* (1997) in their study reported that MRI is highly sensitive in the diagnosis of pre-epiglottic space and base of tongue invasion and is superior to CT.[58] Spector JG *et al* (2001) in their study reported that the incidence of distant metastases varied according to the site of primary tumor : 3.1% to 8.8% in glottic SCC and 3.7% to 15 % in supraglottic SCC.[59] Schalfuss IM *et al* (2002) in their study reported that cross sectional imaging with CT and MRI plays a crucial role in the evaluation of cancers of hypopharynx and cervical esophagus.[60] Clinical examination including endoscopy often fail to detect the full extent of this tumor as it has high propensity to grow in submucosal fashion. Detailed description of the cross sectional anatomy and of the tumor growth pattern aids in the detection and evaluation of the full extent of the lesion. Steve Connor (2007) in his study reported that the lung is the most common site for the systemic metastases with mediastinum, bone and liver sites being well recognized.[61] Loevner LA *et al* (1997) in their study reported that approximately 15% of patients with supraglottic carcinoma and 3% of patients with glottic carcinoma develop distant metastases within two years of diagnosis.[58] Varsha Joshi *et al* (2014) reported that the single most frequent site for distant metastases in laryngeal SCC is the lung , followed by bones and the abdomen.[50] Systemic metastases are encountered in patients with the advanced stage laryngeal SCC and upstage the disease from $M_0$ to $M_1$. Presence of systemic metastases upstages the disease to M1 and precludes curative attempts by surgery. Our findings in this study are in accordance with the above mentioned studies.

In all the patients under study histopathological examination of the biopsy specimens were diagnosed as squamous cell carcinoma. Fredman I *et al* (1993) in their study reported that squamous cell carcinoma is the most common malignant tumor of the larynx, responsible for between 85 % and 95% of the laryngeal malignancies. [62] Hoffman HT *et al* (1997) in their study reported that vast majority of 95% of the neoplasm of the hypopharynx and cervical esophagus are squamous cell carcinomas.[63] Mastronikolis *et al* (2009) in their study reported that more than 95 % of laryngeal tumors are squamous cell carcinomas.[64] Varsha Joshi *et al* (2014) in their study reported that over 90% of the laryngeal carcinomas were SCC. These results are in close approximation with our study results**.**

Fine Needle Aspiration Cytology (FNAC) of node positive patients (n=11); In our study imaging (USG, CECT ±CEMRI) of neck upstaged 5 patients (45.45%) with $N_1$ nodes (clinically) to $N_2$ (radiologically) [1 to N2a, 2 to N2b and 2 to N2c ], 1

patient (9%) with N3 level clinically was not upstaged on imaging .On USG-FNAC of these upstaged nodes and largest node palpable clinically metastatic deposits of squamous cell carcinoma were diagnosed in all the nodes i.e accuracy of 100%. Friedman *et al* (1984) in their study observed that the CT scan increases the clinical accuracy in detecting cervical lymph adenopathy.[65] Van den Brekel MW *et al* (1993) in their study based on neck dissection speciemens, compares the value of palpation with computed tomography (CT), magnetic resonance imaging (MRI) and ultrasound (US) with or without guided aspiration cytology for neck node staging.[66] One hundred and thirty-two patients with squamous cell carcinoma of the head and neck were examined radiologcally before undergoing a total of 180 neck dissections as part of their treatment. CT, USG and MRI proved to be significantly more accurate than palpation for cervical lymph node staging. The accuracy of US-guided aspiration cytology was significantly better than of any other technique used in this study. Modern imaging techniques are essential for appropriate assessment of neck node metastases. Baatenberg De Jong *et al* (1989) in their study evaluated the value of ultrasound examination, combined with cytologic examination, of neck nodes. Ultrasound examination was characterized by high sensitivity, i.e 96.8%; specificity was 32.0%.[67] When the results of ultrasound-guided fine-needle aspiration biopsy were added to the ultrasound findings, specificity was as high as 92.9%. From these results, it was concluded that ultrasound examination with fine-needle aspiration biopsy is an accurate method for assessment of the neck in head and neck oncology. The results of our study are almost in accordance with the above mentioned studies. In present study showed that the socioeconomic status class of patients using the Kuppuswamy scale as; 9 (36%) patients belonged to class IV, 8 (32%) patients belonged to class III, 4 (20%) patients belonged to class II, 3 (12%) patients belonged to class V and 1 (4%) patient belonged to class I, i.e. the upper class constitutes 20% (5 patients), middle class 32% (8 patients) and lower class with maximum of 48% (12 patients). The clinico-radiological stage of patients in our study according to the AJCC 2010 tumor stage was stage II (32%), stage III (32%) and stage IV (36%). Groome PA *et al* (2006) reported that socioeconomic status was not related to either outcome for those with supraglottic cancer, but an association was present in glottic cancer. [68] Association including age, sex, rural residence, tumor stage, lymph node status, use of diagnostic imaging, treatment type and treatment waiting time. People with lower socioeconomic status experience greater cancer incidence and shorter survival times after a cancer diagnosis. Generally, this finding has been true for head and neck cancers, including laryngeal cancer. Yet, socioeconomic status, a function of income, education and occupation, does not itself cause cancer or poor outcomes. Rather, it is a marker for underlying physical and social factors that cause disease, disease recurrence and reduced survival. Such difficulties can lead to access problems along the entire spectrum of care, starting with early detection issues and delays in diagnosis after the appearance of initial symptoms. Along with logistical barriers to access, people of lower socioeconomic status are more likely to be uninformed about early detection programmes and disease management, the signs, symptoms and availability of treatment for cancer. Lastly, quality of care may vary by socioeconomic status. Mackenzie K *et al* (2009) in their study reported that the laryngeal incidence also has a strong socioeconomic association, being twice as common in the more deprived groups compared to more affluent groups.[2] These findings were in accordance with our study.

## CONCLUSION

Carcinomas of larynx and hypo-pharynx are common primary head and neck malignancies and the incidence of these malignancies have a strong socioeconomic association, being twice as common in the more deprived groups compared to more affluent groups. Endoscopic examination proved beneficial in preoperative assessment of laryngeal and hypopharyngeal malignancies especially with respect to vocal cord movement, tumor localization and photographic documentation of extent of lesion for future reference. Imaging (USG, CECT±CEMRI) plays a significant complementary role to clinical endoscopy in pretherapeutic staging of laryngeal and hypo pharyngeal malignancies. Determination of the precise extent of cancer spread within the larynx and hypo pharynx (T staging) is the single most critical factor guiding treatment decisions in patients with localised laryngeal and hypo pharyngeal cancer. Additionally imaging studies are routinely used to assess associated nodal disease (N staging) and systemic metastases (M staging), presence of synchronous cancers and also post-therapeutic tumor recurrence in these patients. A clear understanding of the standard imaging techniques and protocols for imaging the larynx and hypopharynx and familiarity with the key anatomical features and characteristic patterns of tumor spread within the different regions of the larynx and hypopharynx are fundamental to the interpretation of CT and MRI scans of these patients.

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**Cite this article as:**

Rashad Rafiq Mattoo, Sajad Majid Qazi, Basharat Rashid, Zubair Lone, Junaid Nazir Dandroo. Clinico-endoscopic and radiological assessment in the pretherapeutic staging of laryngeal and hypopharyngeal malignancies. J Biol Sci Opin 2016;4(5):159-170 http://dx.doi.org/10.7897/2321-6328.04539

Source of support: Nil; Conflict of interest: None Declared

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