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Multidetector Computed Tomography in Suspected Oral, Oropharyngeal and Hypopharyngeal Cancer: Imaging and Clinical Correlation

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Abstract: ***The predominant disease in the oral cavity and pharynx is cancer which forms a major oncology concern in India constituting about 30% of all the malignancies due to the high prevalence of tobacco chewing in the form of Gutka, Khani or Mawa, tobacco quid (Paan) or Areca nut in India.1 Squamous cell carcinoma accounts for 90% of cases of malignancy to affect this region. The development of modern cross section imaging techniques i.e. CT and MRI has substantially altered the treatment and management of malignancies of oral cavity. ANA staging accuracy of clinical examination with endoscopy was only 58%, but it was increased significantly when combined either with CT (accuracy 80%) or with MR imaging (accuracy 85 %). These cross – sectional imaging techniques are also important for localization of potential biopsy sites in patients with occult primary and helped the surgeon in taking biopsy from the exact site instead of taking random multiple biopsies on a clinical assessment. Other imaging modalities like color Doppler and PET have also contributed to head and neck imaging especially in evaluation of nodal status***

Keyword: Oral cancer, MDCT, MRI, Oropharynx

1. Introduction

Imaging of the oral cavity, oropharynx and hypopharynx, which comprises the upper portion of the aero-digestive tract has always been challenge to general radiologist. These three regions are distinguished from each other because pathologic processes differ in their presentations, prognosis and histological grades.

The oral and pharyngeal cancer forms a major oncology concern in India constituting about 30% of all the malignancies due to the high prevalence of tobacco chewing in the form of Gutka, Khani or Mawa, betel tobacco quid (Paan) or Areca nut or Paan (without tobacco). Squamous cell carcinoma accounts for 90% of cases of malignancy to affect this region[1].

Tumor volume and lymph node infiltration are important factors that influence the therapeutic approach and the prognosis of the patient with SCC. Direct laryngoscopy is most accurate in evaluating the mucosal surface of the aerodigestive tract. In fact, such examinations frequently identify superficial carcinomas that cannot be detected on MRI or CT. Submucosal extension cannot be sufficiently assessed by endoscopy and physical examination but can be evaluated with MRI or CT. Clinical examination alone frequently underestimates the extent of disease.

Pretherapeutic staging of the tumors of the oropharynx, hypopharynx, the oral cavity and floor of mouth is important and should be thorough and exact to ensure appropriate therapy. Particularly important is the assessment of infiltration of deeper compartments and the topographic relationship of the tumor to vascular structures.

Cross sectional imaging techniques like multidetector spiral - CT scan and MRI have significantly altered the treatment and management of the oral cavity and oropharyngeal and hypopharyngeal lesions and are considered as modalities of choice for assessing this complex region[1]. Their main advantages reside in their capacity to show at best the normal anatomy and exact extent of low lying tumours. CT Scan outlines most lesions satisfactorily especially after administration of contrast material with good temporal and spatial resolution, is optimal for defining bone destruction and identification of metastatic lymphadenopathy[2].

Axial images with a slice thickness of 5 mm are advocated in various imaging protocols, although MDCT technology is capable of acquiring high-resolution (submillimeter) studies of the whole neck in less than 20seconds. When overlapping images are reconstructed from raw data with a nominal slice thickness of 0.5–1.25 mm, multiplanar reformation (MPR) images of the tumor can be viewed interactively in arbitrarily chosen imaging planes. The price for this is a significant increase in reconstruction and data transfer time and storage demands. In addition, hundreds of images to review can
diminish the productivity of a radiologist.

On the other hand MRI provides excellent tumour contrast with good delineation of tumour margins and early detection of bone marrow invasion with considerable fewer artifacts from bone and dental amalgams.In current publications

however there are no definite guiding principles whether MDCT or MRI should be used as a primary imaging modality for oral cavity and oropharyngeal carcinomas.

Oral cancer being the 3rd most common type which accounts for over 30% of all cancers in the country. Relatively the mean age of occurrence is around 55 years, in the adult population. Incidence in the pediatric population is comparatively <0.25%. Younger individuals are the susceptible sector of the society, with an undue exposure of risk factors such as tobacco. 2/3rd of the oral cancer is prevalent in males whereas there is much variation in females. Effect of ageing and regional differences are associated with disease-specific risk factors, that attribute to the variation in incidence and pattern of the disease. Over 5 people in India die every hour everyday because of oral cancer and the same number of people die from cancer in oropharynx and hypo pharynx. CANCER registration is not compulsory in India, so the true incidence and mortality may be higher, as many cases are unrecorded and loses follow up[3]. Most commonly the disease involves patients in the 5th through 7th decades of life. Men are afflicted 3 to 5 times as frequently as females. Smoking, tobacco and alcohol abuse constitute the most significant risk factors.

Oral Cavity consists of multiple sites/regions and includes lip, alveolar ridges, hard palate, retro-molar trigone, floor of mouth, anterior 2/3 of the tongue and buccal mucosa.[4]

Oropharynx is that portion of pharynx, which extends from the anterior tonsillar pillar inferiorly to the pharyngoepiglottic folds and superiorly to the soft palate. It includes base of the tongue, the tonsil, the tonsillar fossa, the soft palate and the posterior pharyngeal wall.[5]

Hypopharynx begins as the continuation of the oropharynx at the pharyngoepiglottic fold superiorly, and extends inferiorly to the inferior aspect of the cricoid cartilage, where it continues as the cervical oesophagus. Hypopharyngeal cancers are often named for their location, including pyriform sinus, posterior pharyngeal wall, or postcricoid pharynx. Most of the hypopharyngeal carcinomas arise in the pyriform sinus. In India, 65-85% of hypopharyngeal carcinomas involve the pyriform sinuses, 10-20% involves the posterior pharyngeal wall, and 5-15% involve the postcricoid area.[6]

Aim

To compare and correlate CT staging of oral, oropharyngeal, hypopharyngeal malignancies with clinical staging.

Objective

1) To study the contribution of CT in providing additional information about the lesions.
2) To assess the extent of local, regional spread, depth of invasion and extent of lymphadenopathy for staging and treatment planning in advanced oral and pharyngeal malignancy.
3) To study and record osseous involvement.

2. Material & Method

2.1 Study Design:

A Prospective study conducted between June 2014 - Jan 2016, suspected of having oral and pharyngeal malignancies, in the Department of Radio-diagnosis, Krishna hospital, Krishna institute of Medical sciences, Karad were included in this study.

2.2 Sample Size:

After assessment of exclusion & inclusion criteria total 70 patients suspected of having oral and pharyngeal malignancies were included in the study provided the clinical diagnosis was confirmed on histopathological examination.

2.3 The Following Were Excluded From The Study:

1) Patients who have received some form of therapy (RT/CCT/Surgery).
2) Patient's allergic to iodinated contrast media.
3) Metastases in the region of interest due to primary elsewhere.
4) Un-cooperative or very sick patients.

Patient's names, age, gender, dietary habits, life style, presenting symptoms and signs were recorded as per the proforma. Each patient was subjected to a clinical examination including neck palpation, direct /indirect laryngoscopy, fiberoptic/rigid endoscopy and clinical staging was there by obtained. Thereafter, the patient underwent baseline computed tomographic examination of the relevant area.

3. Scanning Protocol

The computed tomography examination was performed on Siemens Emotion 16 MDCT with tube voltage, 120 kV; effective tube current, 150 mAs; collimation, 0.75 mm; table feed, 12 mm/rotation; and rotation time, 0.5 second. The effective radiation dose for a typical scanning range of 250 mm was 3.6 mSv for men & 4.1 mSv for women.

The patient lies supine on gantry table and was instructed against swallowing, moving or talking during scanning. Contiguous 5 mm sections will be obtained from canthomeatal line to the thoracic inlet.
5mm sections were retro reconstructed in 1.5 mm axial, coronal and Sagittal planes.

The axial sections were taken parallel the body of the mandible.

In cases of extensive primary lesion the sections were extended till the superior or inferior limit of the lesion. The CT study was carried out after administration of bolus of 100 ml of non ionizing iodinated contrast media (Omnipaque) administered intravenously at the rate of 3ml/second, after obtaining pre-contrast sections in the region of interest. Two phases were obtained; Arterial phase

at 25 seconds and Delayed phase at 180 sec from the time of administration of contrast.

For the purpose of staging, the staging schemes in common use currently (viz. TNM primary tumor staging, AJCC radiological nodal staging, clinical classification of nodes, (details in Annexure A,B,C,) were followed in each case.

Radiological Criteria for Lymph Nodes Metastasis:

1) Minimal axial diameter of 1cm (in short axis)
2) Central Necrosis.
3) Irregular ill-defined outline.
4) Conglomeration of lymph nodes

Criteria Used for Extra Nodal Extension:

1) Intranodal tumor - well circumscribed mass with a distinct interface between it and surrounding fat.
2) Extranodal tumor - Ill-defined staining margin without clear distinction between it and surrounding fat.Evidence of edema of thickening of surrounding fibro adipose tissueor muscles.
3) Fixation - combination of extra-nodal characteristics and loss of fat plane between mass and structure in question (e.g. Carotid, sternocleidomastoid muscle).
4) Adherent or abutting - Combination of intra-nodal characteristics and loss of fat plane between mass and structure in question.

Perineural Extension of the Tumor Was Defined As:

1) Enlargement of neural foramen.
2) Thickening or abnormal enhancement of the nerve.
3) Abnormal soft tissue density in relation to the nerve, not contiguous with the primary lesion.
4) Atrophy of the muscles supplied by the nerve.

Interpretation of images was done without detained prior information of the results of clinical examination and the malignancy was staged independently (according to the guidelines mentioned in the AJCC Manual for Staging of Cancer, Edge SB, Byrd DR, Compton CC, et al., eds.: AJCC Cancer Staging Manual. 7th ed. New York, NY: Springer, 2010.)[7]

Annexure –A

TNM Classification of primary tumor for carcinoma of Oropharynx, oral cavity (Including Lip)

TX	Primary tumor cannot be assessed.
T0	No evidence of primary tumor.
Tis	Carcinoma in situ.
T1	Tumor ≤2 cm in greatest dimension.
T2	Tumor >2 cm but ≤4 cm in greatest dimension.
T3	Tumor >4 cm in greatest dimension.
T4a	Moderately advanced local disease.
	(Lip) Tumor invades through cortical bone, inferior alveolar nerve, floor of mouth, or skin of face, that is, chin or nose.
	(Oral cavity) Tumor invades adjacent structures only (e.g., through cortical bone [mandible or maxilla] into deep [extrinsic] muscle of tongue [genioglossus, hyoglossus, palatoglossus, and styloglossus], maxillary sinus, or skin of face).
T4b	Very advanced local disease.
	Tumor invades masticator space, pterygoid plates, or skull base and/or encases internal carotid artery.

Annexure -B

TNM Classification of primary tumor for carcinoma of the Hypopharynx

TX	Primary tumor cannot be assessed
T0	No evidence of primary tumor
Tis	Carcinoma in situ
T1	Tumor limited to one subsite of hypopharynx and/or 2 cm or less in greatest dimension
T2	Tumor invades more than one subsite of hypopharynx or an adjacent site, or measures more than 2 cm but not more than 4 cm in greatest dimension without fixation of hemilarynx
T3	Tumor more than 4 cm in greatest dimension or with fixation of hemilarynx or extension to esophagus
T4a	Moderately advanced local disease.
	Tumor invades thyroid/cricoid cartilage, hyoid bone, thyroid gland, or central compartment soft tissue.
T4b	Very advanced local disease.
	Tumor invades prevertebral fascia, encases carotid artery, or involves mediastinal structures Tumor invades prevertebral fascia, encases carotid artery, or involves mediastinal structures.

ANNEXURE-C

Nodal Classification

NX	Regional lymph nodes cannot be assessed.
N0	No regional lymph node metastasis.
N1	Metastasis in a single ipsilateral lymph node, ≤3 cm in greatest dimension.
N2	Metastasis in a single ipsilateral lymph node, >3 cm but ≤6 cm in greatest dimension.
	Metastases in multiple ipsilateral lymph nodes, none >6 cm in greatest dimension.
	Metastases in bilateral or contralateral lymph nodes, none >6 cm in greatest dimension.
N2a	Metastasis in single ipsilateral lymph node, >3 cm but ≤6 cm in greatest dimension.
N2b	Metastases in multiple ipsilateral lymph nodes, none >6 cm in greatest dimension.
N2c	Metastases in bilateral or contralateral lymph nodes, none >6 cm in greatest dimension.
N3	Metastasis in a lymph node >6 cm in greatest dimension.
N3en	Extra nodal malignant spread

Annexure-D

Clinical Classification of nodes

Level	Location
I	Sub mental and submandibular nodes
II	Internal jugular nodes from the skull base to level of carotid bifurcation (up to hyoid bone)
III	Internal jugular nodes from carotid (supra omohyoid portion)
IV	Infraomohyoid portion of internal jugular chain
V	Posterior triangle nodes (lateral to posterior border of the sternocleidomastiod muscle)
VI	Nodes related to the thyroid gland
VII	Tracheoesophageal groove nodes and superior mediastinal nodes

4. Observation & Result

Out of seventy cases of oral cavity, oropharyngeal and hypopharyngeal malignancies included in this study 34 cases (49%) were from oral cavit,16 cases (23%) were from oropharynx and 20 cases (28 %) from hypopharynx . These cases were further categorized according to the subsites and M/F ratio.

Of the total no. of cases maximum no. of cases were seen in 4th and 5th decade i.e. 72%.About 22% of cases were seen above 60 years of age.And only 6% cases below 40 years.

42% of patients presented with oral or neck mass.About 30% of cases had a pre-existing oral ulcer and in 10% cases there was a history of leukoplakia.

88% of the cases studied had a history of tobacco use commonly in term of bidi or cigarette. However, chewing pan &Gutkha was also common.20 % of patients had history of long-term alcohol abuse.Only 10% patients had no history of tobacco or alcohol abuse of which most were females

Oral Cavity

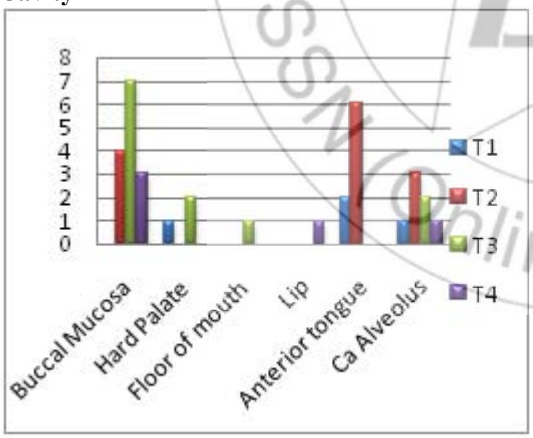

Chart 1: T staging according to primary site as evaluated by Clinical staging

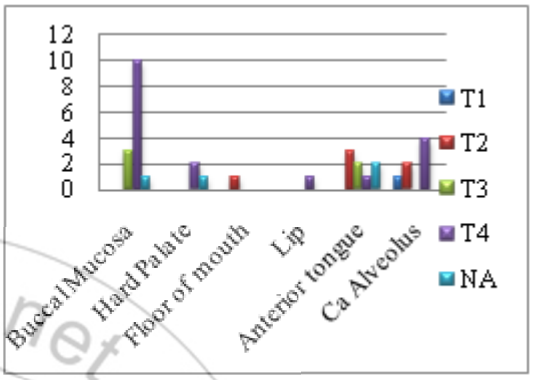

Chart 2: T staging according to primary site as evaluated by CT staging

- Most of the primary malignant lesions evaluated clinically in our study for oral cavity were T2 lesions **(38.2%)**However on CT most cases were stage T4 **(50%)**
- In 15/34 cases **(44.1%)** the T-stage of CT correlated well with clinical stage.
- In 14/34 cases **(41.1%)** the T-stage was upgrade by CT stage as compared to clinical evaluation.
- 4 cases (11.7%) two each of hard palate and anterior tongue were graded as NA on CT Scan because of the superficial ulcerative nature of the lesions. CT could only diagnosis some thickening of hard palate in these cases even on coronal scanning.
- Another case of carcinoma of floor of mouth was under staged by CT even on coronal scan because of superficial ulcerative nature of the lesions.
- Significant additional information was however provided by CT in the above 5 cases of oral cavity that was important during surgery.

Table 1: Additional information provided by CT for upgrading T-Stage in 18 cases.

S no	Site	Clinical T- stage	CT-T stage	Add. Information provided by CT
1	BM	T2	T4	Increase size, extn. -B, Ma, ITF.PT, SK
2	BM	T2	T4	Increase size, extn. - B, Ma, osseous involvement of Mx.
3	BM	T2	T4	Increase size extn. - B, Ma, ITF.PT, PTM
4	BM	T2	T4	Increase size, osseous involvement Md.
5	BM	T2	T4	Increase size, extn- B, Ma, low ITF .
6	BM	T3	T4	Increase size, osseous involvement Md.
7	BM	T3	T4	Increase size, extn. - B, Ma, osseous involvement of Md.
8	HP	T3	T4	Extn. -mx, FO.

9	AT	T2	T4	Increase size, extn. -FM, LPW, Lx, V, T. & Branchial cyst
10	AT	T1	T4	Extn. -B, GBS.
11	AT	T2	T3	Increase size, involvement of Hypoglossal N.
12	AT	T1	T2	Increase size, extn. -CM, GEF.
13	AT	T2	T3	Increase size, extn. -T, FM
14	AMd	T3	T4	Increase size, extn. -LPW, GBS, FM, SMG.
15	AMd	T2	T4	Increase size, extn. -B, SMG, BM, DM, Inferior N. Involvement.
16	AMx	T3	T4	Extn. -PTF, PPW, ITF, SP. Erosion of Mx, PT.
17	AMd	T1	T4	Increase size, extnFM, CK, B, LPW
18	AMd	T2	T4	Increase size, extnB.

Deep extend of tumor as detected by CT examination
Depth of skin invasion – 4
Pterygomandibular raphe invasion – 3
Maxilla invasion – 3
Mandible invasion –4
\Pterygopalatine fossa invasion secondary to retromolar trigone invasion – 2
Perineural extension – 2
Intra cranial extension – 1

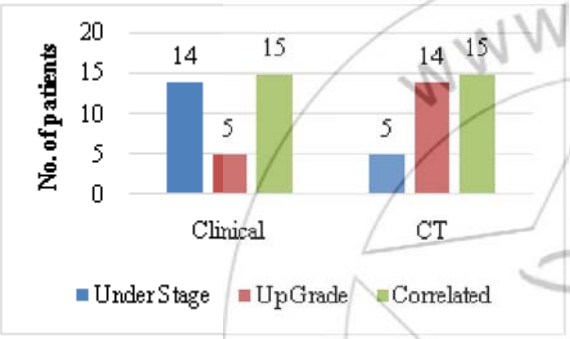

Chart 3: T - Stage of Primary lesion of Oral Cavity by Clinical and CT Evaluation -

Accuracy of CT in T-stage - 29/34 = 85.2 %
Accuracy of Clinical T-Stage - 20/34 = 58.8%,
In 41.1% of case CT upgrade the primary tumor stages.

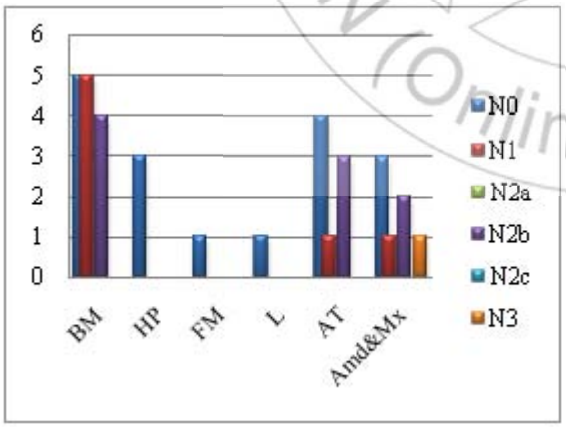

Chart 4: N staging according to primary site as evaluated by Clinical staging

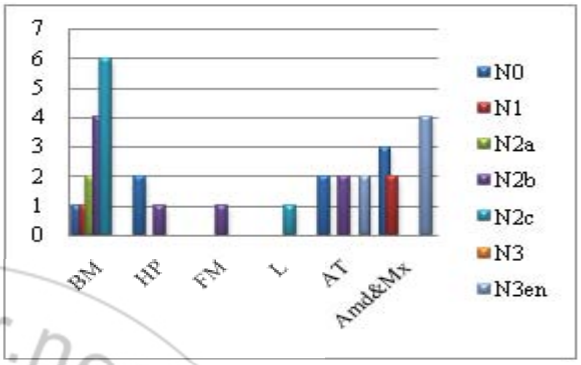

Chart 5: N staging according to primary site as evaluated by CT staging

Table 2: Additional Information Provided by CT in N - Stage in 18 cases

S. no	SITE	Clinical N- Stage	CT N- Stag	Add. Information Provided By CT
1	BM	N0	N2c	CN, B\L
2	BM	N0	N2c	CN, B\L
3	BM	N0	N2c	CN, B\L
4	BM	N0	N2c	CN, B\L
5	BM	N1	N2a	CN
6	BM	N1	N2a	CN
7	BM	N1	N2c	CN, B\L
8	HP	No	N2b	MN
9	FM	N0	N2b	MN
10	L	NO	N2c	B\L, MN
11	AT	N2b	N3en	CN, B\L, ExS
12	AT	N0	N1	CN
13	AT	N2b	N3en	B\L, CN, ExS
14	AT	N0	N2b	B\L, MN
15	AMd	N2b	N3en	CN, ExS
16	AMx	N1	N3en	MN, CN, ExS
17	AMx	N2b	N3en	B\L, CN, ExS
18	AMd	N3	N3en	CN, ExS

Central necrosis was seen in 15 cases.
Extra capsular spread was noted in 6 cases

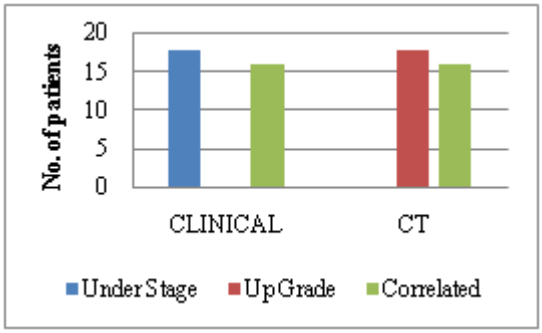

Chart 6: Change in N-stage of primary lesion of oral cavity by clinical and CT evaluation

Accuracy of CT in N-staging 32/34 – 94.1%
Accuracy of Clinical N-Staging 16/34 – 47.0%
In 52.9% cases CT upgraded the N-stage of the primary tumor.

Oropharynx

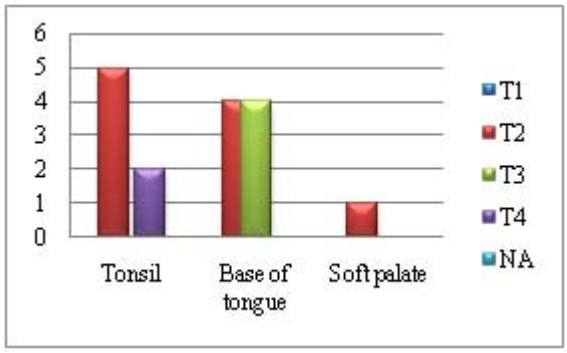

Chart 7: T staging according to primary site as evaluated by Clinical staging

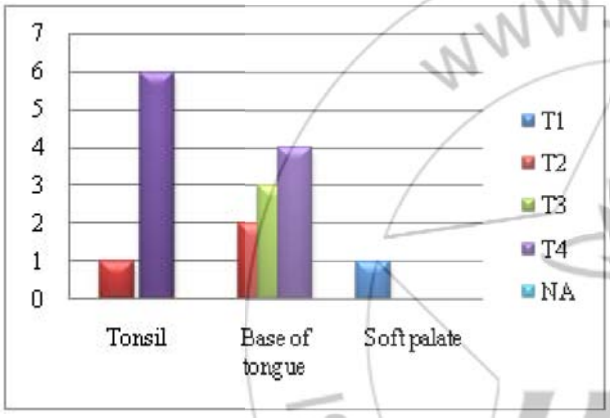

Chart 8: T staging according to primary site as evaluated by Clinical staging

Most of the primary malignant lesions evaluated clinically in our study were T2 lesions (62.5%) However on CT most cases were stage T4 (56.2%)

8/16 cases (50%) the T- stage of CT correlated well with clinical staging.

7/16 cases (43.7%) the T-stage was upgraded by CT staging as compared to clinical evaluation. One case of soft palate was under estimated by CT because of the superficial ulcerative nature of the lesion.

Table 3: Additional Information Provided by CT in 7 Cases of Oropharynx

SITE	CLINICAL T- Stage	CT T-Stage	Add. Information Provided By CT
T	T2	T4	Inc. Size, ExT-BT, SMG
T	T2	T4	ExT-SP, SMG, BT, PTM
T	T2	T4	Inc. Size, ExT-BT, LT, SMG
T	T2	T4	ExT-B/LT, PPW, SP
BT	T3	T4	ExT-SP, NP, LP
BT	T2	T4	Inc. Size, ExT-PPW, T, CM
BT	T2	T4	ExT-AT, SP, V Inc. Size

Oropharyngeal Carcinoma Deeper Invasion Assessed by CT
Pre epiglottic fat – 3
Pre vertebral musculature – 4
Pterygopalatine fossa – 3
Pterygomandibular fossa – 1
Midline crossing into base of tongue – 5

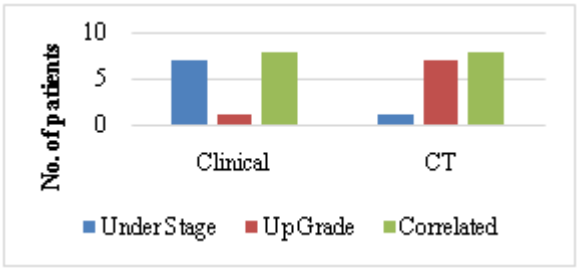

Chart 9: Change in T-Stage of Primary Lesion by clinical and CT Evaluation

Accuracy of CT T-Stage - 15/16 = 93.7%
Accuracy of Clinical T-Stage - 9/16 =56.2%
In 43.7% cases CT upgraded the primary tumor stage in malignancy of oropharynx
In 6.2% cases were under staged by CT

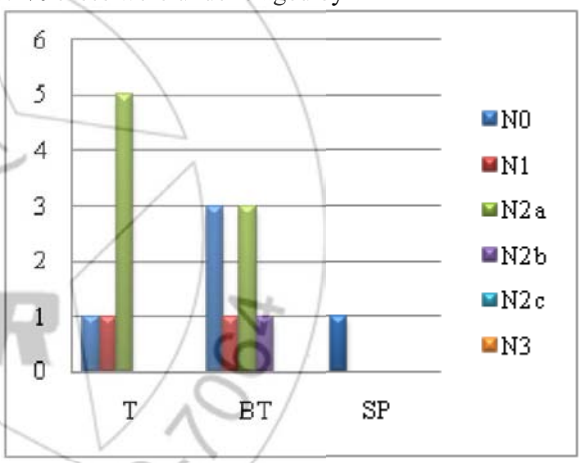

Chart 10: N staging according to primary site as evaluated by Clinical staging

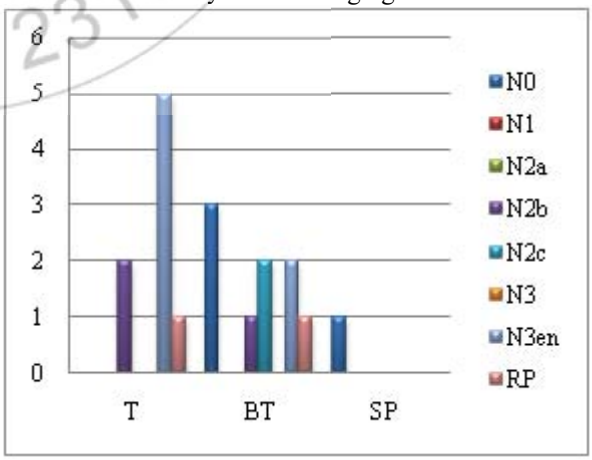

Chart 11: N staging according to primary site as evaluated by CT staging

8/16 cases (50%) correlated with N-stage of clinical examination. Central Necrosis was seen in 8 cases.
Extracapsular spread was noted in 7 cases.
In all cases minimum axial diameter of node was > 1cm

In 2 cases additional Retropharyngeal nodes was involved.

Table 4: Additional Information Provided by CT in 8 cases

Site of Primary Lesion	Clinical N- Stage	CT N-Stage	Add. Information Provided By CT
T	N2b	N3en	CN, ExS
T	N0	N3en	U\L, SN, CN, ExS
T	N1	N3en	MN, CN, ExS, RPN
T	N2b	N3en	B\L, CN, ExS, Increase Size
T	N2b	N3en	CN, ExS, Encasement CS
BT	N1	N2c	B\L, MN, CN, RPN
BT	N2b	N3en	B\L, CN, ExS
BT	N2b	N3en	B\L, CN, ExS

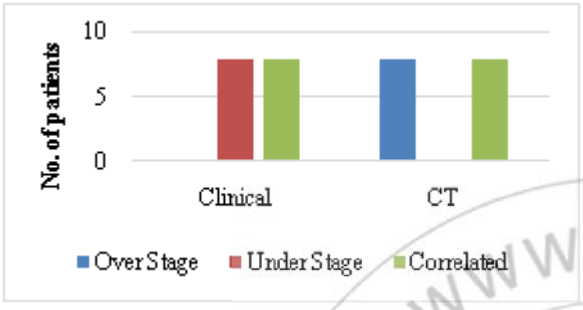

Chart 12: Change in N-stage or Primary Lesions of Orophagynx by Clinical and CT Examination.

Accuracy of CT in N-stage 16/16 = 100%
Accuracy of Clinical N - Stage 8/16 = 50%
In 50% cases CT upgrade the N-stage of primary tumor.

Hypopharynx

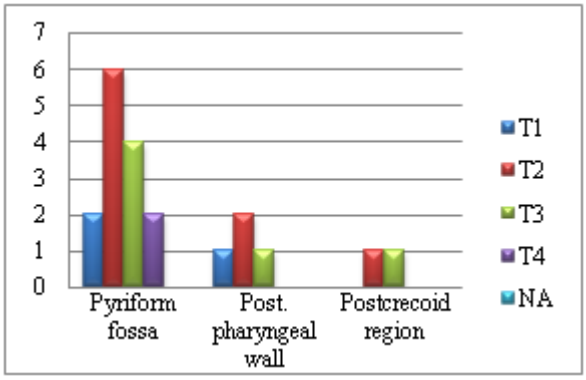

Chart 13: T staging according to primary site of hypopharynx as evaluated by Clinical staging

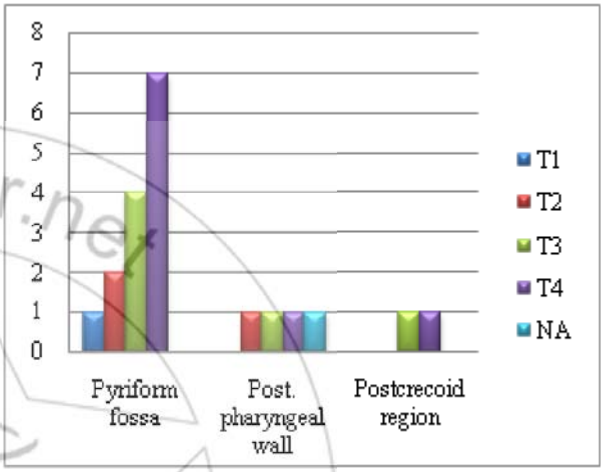

Chart 14: T staging according to primary site of hypopahrynx as evaluated by CT staging

Most of the primary malignant lesions evaluated clinically in our study were T2 lesions (45%);However on CT most cases were stage T4 (45%) 12/20 cases (60%) the T- stage of CT correlated well with clinical staging.8/20 cases (40%) the T-stage was upgraded by CT staging as compared to clinical evaluation. One case of posterior pharyngeal wall was under estimated by CT because of the superficial ulcerative nature of the lesion.

Table 5: Additional Information Provided by CT in 7 Cases of Hypopharynx

SITE	CLINICAL T- Stage	CT T-Stage	Add. Information Provided By CT
PF	T2	T4	Inc. Size, ExT-PPW,TC,AC, NP
PF	T2	T4	Inc. size, ExT- PPW,TC,AC
PF	T2	T4	Inc.size, ExT-PPW, LPW, TC CC
PF	T1	T4	Inc.size, ExT-PPW, LPW, TC CC
PF	T3	T4	Inc. Size ExT-PW,TC ,AC,VC
PPW	T2	T4	Inc. Size ExT-VC, TC, PVF
PCRR	T2	T4	Inc. Size ExT-PVS, TC, TG

Hypopharyngeal Carcinoma
Deeper Invasion Assessed by CT
Pre vertebral space– 1
Thyroid cartilage – 3
Cricoids cartilage– 3
Ventricular band invasion- 2
Subglttic space involvement -2
Extension to nesopharynx-1
Vocal cord involvement: 2
Thyroid gland involvement -2

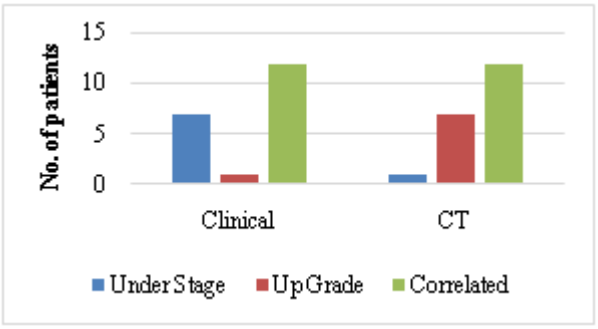

Chart 15: Change in T-Stage of Primary Lesion by Clinical and CT Evaluation

Accuracy of CT T-Stage - 19/20 = 95%
Accuracy of Clinical T-Stage - 12/20 =60%
In 35% cases CT upgraded the primary tumor stage in malignancy of hyoropharynx
In 5% cases were under staged by CT

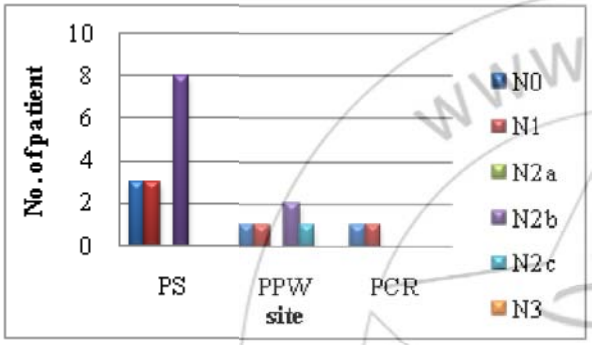

Chart 16: N staging according to primary site as evaluated by Clinical staging

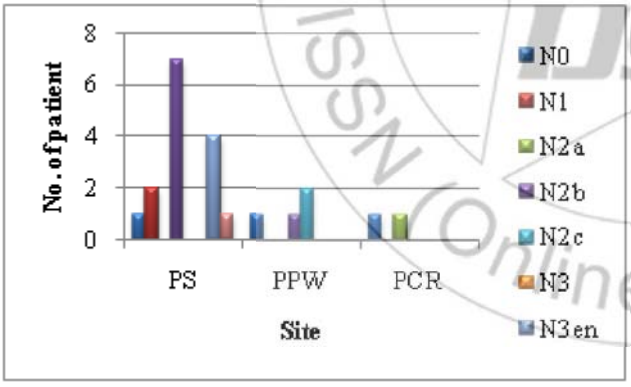

Chart 17: N staging according to primary site as evaluated by Clinical staging

TABLE 6
Additional Information Provided by CT in 8 cases

Site of Primary Lesion	Clinical N- Stage	CT N-Stage	Add. Information Provided By CT
PS	N0	N3en	CN, ExS
PS	N0	N3en	U\L, SN, CN, ExS
PS	N2b	N3en	MN, CN, ExS, RPN
PS	N0	N3en	B\L, CN, ExS, Increase Size
PPW	N2b	N2b	CN, inc size
PPW	N0	N2b	MN, CN, RPN
PPW	N1	N2c	B\L, CN
PCR	N2b	N3en	B\L, CN, ExS

12/20 cases (60%) correlated with N-stage of clinical examination. Central Necrosis was seen in 8 cases.
Extra capsular spread was noted in 4 cases.
In all cases minimum axial diameter of node was > 1cm
In 1 case additional Retropharyngeal nodes was involved.

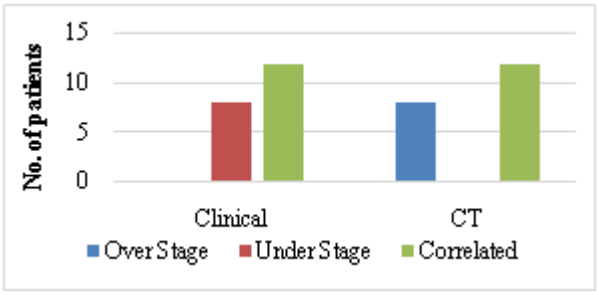

Chart 18: Change in N-stage of Primary Lesions of hypopahaynx by Clinical & CT Examination.

Accuracy of CT in N-stage 20/20 = 100%
Accuracy of Clinical N - Stage 12/20 = 60%
In 40 % cases CT upgrade the N-stage of primary tumor.

5. Discussion

This study conducted in the Department of Radio-Diagnosis, Krishna Hospital, Karad included 70 new cases of oral cavity and pharynx.

Sex Distribution
The distribution of cases according to the sex was 60 males and 10 females, constituting the sex ratio of 6: 1. Men are more commonly affected than females.

Age Distribution
Our study also demonstrated that 65% of cases were in the age group of 40 to 60 years, in accordance to observations made by Notaniet al[10]; Hospital Cancer Registry. About 22% of cases were seen above 60 years of age. And only 6% of cases below 40 years of age.

Risk Factors
In our study 88% cases gave a history of the use of tobacco in one of its forms, bidi, cigarette, pan, gutkha etc. Another 24% patients had a history of alcohol intake, which is known for its synergistic effect in the cancer causation. These findings corresponded to the data published by Notaniet al.[8], who reported a 90% attributable risk of oropharyngealtumors associated with the use of tobacco in one of its forms. Desai et al [14] also stressed on the role of tobacco in causation of the malignant lesions in oral cavity.

Distribution of Malignancies According to the Primary Site
Most of the cases in our study were of oral cavity (49%); Oropharynx (23%) and (28%) were of oropharynx. Our data corresponded to the cumulative data published by the National Cancer Registry Programme, and the Delhi Cancer Registry[12]. In oral cavity maximum no of cases were of Buccal mucosa. Tonsil and base of tongue constituted most of the cases of oropharynx and Pyriform fossa in hypopharynx which correlated with the data Vincent Devitaet al.[7]

Classification of Oropharyngeal Malignancies by Histological Type

In our series 92.5% cases were of squamous cell carcinoma. 5% cases were adenocystic carcinoma of minor salivary glands. And only 2.5% cases were of NHL. The above percentage correlated well with V. Devitaet al.[10]

Stage Distribution

Most of the tumor (70%) in this study were advanced lesion as evaluated by CT in T3 and T4 stages at the time of presentation to our institution, probably secondary to the hospital bias related to the delay in the patient presentation to a tertiary institution like our hospital.

A large number of studies are available comparing the CT findings of the extra-cranial head and neck malignancies with histopathological findings. However, only a few of these compare the CT findings with the clinical findings.

Easy accessibility of this region to the clinical inspection and palpation allows for a thorough clinical assessment of the tumors. Therefore, the majority of cases diagnosed in this area were correctly staged by clinical examination in our study - 19/34 (55.8%) cases of oral cavity and 9/16 (56.2%) cases of oropharynx, 12/20 cases of hypopharynx(60%).The T-description of the tumor by CT and clinical examination were in correlation in 57.3% cases, CT was able to demonstrate additional findings in the rest.

Isotropic data sets can be acquired with modern MDCT scanners in a couple of seconds and MPR images can be generated in excellent quality with the help of picture archiving and communication system (PACS)

F. Aspestrandetal in his study of 36 patients with tumor of oral cavity, pharynx and larynx concluded that a positive correlation between the CT and clinical examination was found in 53% cases.However CT was unable to define 4 primary lesions of oral cavity, two each of hard palate and Anterior two third of tongue due to superficial ulcerative nature of the lesion.In one case of floor of mouth CT could not evaluate the exact size even on coronal scanning because of large superficial component of the lesion.

CT demonstrated perineural extension in 2 cases of oral cavity by demonstrating the denervation atrophy of muscle of tongue in one case and mandible involvement in another case. This correlated well with the study conducted by Mukherji et al[15] who demonstrated the CT criteria for perineural or vascular invasion by aggressive nature or the tumor margins and invasion of the sublingual space.

In 3 cases of oral cavity CT demonstrated maxillary invasion, which was diagnosed only in one case clinically thus, altering the surgical planning. Skin involvement was seen in 4 cases, where it was clinically suspected in only 2 cases. Intra cranial extension was seen in one case of tongue, in which case although primary tumor was not discernable on CT due to superficial nature of lesion but osteolytic metastasis was seen in occipital bone making the staging – M1.Erosion of pterygoid plates was seen in another 2 patients.

In malignancies of oropharynx CT upgraded the primary tumor stage in 43.7% cases and correlated with clinical T-stage in 50% cases. However only in one case of soft palate CT under estimated the true extent of the lesion due to its superficial nature.

CT was able to demonstrate the extension across the midline into base of tongue in 5 cases, of which only 2 were diagnosed clinically.

The demonstration of the pre - epiglottic fat space involvement and pterygopalatine fossa involvement in 3 cases each which did not alter the T – Stage description of tumor, where important to demonstrate as they were considered poor prognostic indicator of tumor control by radiotherapy. Schaefer et al[13] concluded that CT is helpful in detection and delineation of pharyngeal tumors. In 2 cases carotid involvement was demonstrated, not suspected clinically, thus obviating the possibility of dissection of the tumor.

Thus CT is a valuable adjunct to clinical examination in T – staging as also demonstrated by Larrsonet al.[16] who concluded that CT is not a substitute for thorough clinical examination but adds to the information about the greater & deep extent of the lesion. These findings are also in correlation to the reports of various other authors. Murakiet al.[17] reported an increase in T-stage description of 33.3% cases post CT evaluation. Schafer et al.[18] reported that the CT was moderately useful in evaluation of tongue & floor of mouth lesions.

Study by Prehn et al[16] showed a change clinical description in 25% of oral cavity lesions and defined the true extent of tumor infiltration in many more by CT. Larsson SG et [14] in his study concluded that normal mucosal layer of the base of the tongue often show contrast enhancement of the same magnitude as the tumor and can at times be irregular in outline because of co – existing lymphoid tissue. This superficial tumor spread can therefore be difficult to ascertain on CT but be quite obvious for the clinician.

In malignancies of hypopharynx; CT upgraded the primary tumor stage in 40% cases and correlated with clinical T-stage in 60% cases. However only in one case of posterior pharyngeal wall; CT underestimated the true extent of the lesion due to its superficial nature.

In a retrospective study comparing post-surgical pathological and CT features in 19 patients with hypopharyngeal carcinomas, Yan et al.[19] reported that CT scanning has a positive predictive value of 85%, a false negative rate of 5%, and a sensitivity rare of 95%.

In another study on 60 cases of laryngeal and hypopharyngeal carcinomas, D'Souza et al.[20] revealed that when compared to pathological findings, CT scanning has an advantage in diagnosing tumors invading into subglotic areas with accuracy rate of 95%, a specificity rate of 93.5%, and a positive predictive value of 82.5%.

Comparison analysis of CT scanning and pathological examinations in 21 cases ofhypopharyngeal carcinoma by

Li et al[21] found the accuracy of CT to determine carcinoma invading paraglottic space, pre-epiglottic space, fissure of epiglortis, thyroid cartilage and arytenoids cartilage is 100%, 100%, 92.3%, 77.8%, 75% and 50%, respectively. Thus, at present, CT scanning is a reliable method in studying the regional invasion of laryngeal carcinoma.

This study revealed that pyriform sinus carcinoma could easily invade fissure of epiglottis, with a positive rate of up to 98%, which was obviously related to the lateral surface of epiglottic fissure constituting the pyriform sinus. After fissure of epiglottis was invaded, tumors migrated along the surface of mucosa to reach the adjacent epiglottis,vallecula and epiglottis, therefore ipsilateral epiglottis was easier to be involved, similar to the results of Huang et al[22] After epiglottis was invaded, as the tumor progressed, lesions penetrated the surface of mucosa and further invaded the pre-epiglottic space (66%).

Eight cases were detected oropharyngeal side wall invasion and one case of tongue root invasion. Invasions of the oropharyngeal sidewall were caused by direct upward migration of malignancy. Invasions of the tongue root were caused by spreading from epiglottis and pre-epiglottic space. Results in this study suggest that the oropharyngeal sidewall is easier to be involved than other walls. Only one case (5%) at [4b stage], originating from right lateral pyrilorm sinus, spread upwards to the soft palate after invasion to the right lateral wall in oropharynx, but the nasopharynx was not involved.

Our results were in line with those reported by Emami et al which suggests that pyriform sinus carcinoma can easily invade posterior pharyngeal wall via downward migration along the surface of mucosa, but seldom invade esophagus and upper space of lateral wall outside the pyriform sinus, epiglottis, paraglottic space, oropharyngeal sidewall, ventricular band and vocal cord, and so on, on the contralateral side. This may be because these structures are far away from the primary tumor site.

In this study, 4 cases (20%) were posterior hypopharyngeal wall carcinoma, 3 cases (75%) of which were at the advanced stage. These results suggest that posterior pharyngeal wall carcinoma are aggressive and usually invaded aryepiglottic fold anteriorly, prevertebral fascia posteriorly, esophagus inferiorly.

Lymph Nodes

In the present study 44% cases were classified as clinically negative nodes. Post contrast enhanced CT examination, 13 of the 27 clinically negative necks (48.4%) showed evidence of nodes of more than 1cm in size with unequivocal signs of metastasis (central necrosis, extra-capsular spread).

CT also altered the description of N-stage of 38% cases by upgrading the N-stage to N3en in 32% cases and 8% in N2c nodal stage.

This upgrading was done by demonstrating.

- Central necrosis in 30 cases
- Multiple nodes in 14 cases
- 3 cases showing retropharyngeal nodes in oropharyngeal malignancies. In 21 cases CT demonstrated bilateral involvement.

Mancuso et al[23] had reported the presence of Retropharyngeal nodes in primary/recurrent squamous cell carcinoma of head and neck as a poor prognostic indicator.

The extracapsular spread was demonstrated by CT in 26% cases, which was not suspected clinically. This finding was important because apart from being a poor prognostic indictor, it rules out the possibility of radical neck dissection in such patients for regional control of disease.

Earliest reports by Mancuso et al[26]described that 21% patients with clinically negative neck should positive nodes on CT which was confirmed by histopathological studies. Further study by same authors showed a change in 5% cases of clinically negative neck.

Friedman et al reported a 23.3% rate of detection of occult regional metastasis by CT. Lydiatt et al reported positive predictive value of 93% by CT or MR and 67% for clinical examination, thus recommending CT or MR as a routine investigational procedure in all cases of head and neck. Studies by Van den Brekel et al and Caruelho et al[20]substantiated the efficacy of CT in demonstration of tumour positive nodes. Harsson SG et al reported that more than 50% contralateral nodes detected by CT, were missed by clinical examination and started that the diagnostic accuracy of CT superpasses that of the clinical examination.

The findings of our study were in good correlation with those of previous authors. CT also has an impact in patient management, because detection of accult metastasis to regional nodes, contra lateral side, as well as extra capsular spread is poor prognostic. Predicator and alter the patients management. Extracapsular spread when present rules out a radical neck dissection in cases, where it is planned for regional tumor control.

6. Conclusions

Imaging is essential in the management of oral cancers. It augments clinical findings to plan appropriate therapy. MDCT allows rapid scanning and fast acquisition of data helping in reconstruction and generation of excellent quality multiplanner images. MDCT helps in categorization of malignant lesions of the oral cavity and pharynx according to the TNM classification by demonstrating greater extent of tumor through various means. MDCT accurately demonstrates osseous and cartilaginous involvement and determines resectability, helps to plan the precise extent of resection, and indicate whether organ conservation therapy should be offered.

Thus routine use of MDCT is strongly recommended in all the malignancies of extra cranial head and neck region.

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