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# CT Evaluation of Malignant Neck Masses

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**Abstract:** Radiological evaluation of neck masses have changed dramatically since the advent of multidetector computed tomography which permits precise anatomical localization and characterization. The present study was carried out in 59 patients with clinical suspicion of having malignant neck mass with proven histological diagnosis. CT features of malignant neck masses were studied with relevance to enhancement, presence of necrosis, calcification, vascular invasion, obliteration of fat planes and bony invasion. The commonest malignant neck mass was metastases from aerodigestive tract, thyroid gland malignancy was detected in 10 cases. The metastatic nodes from oral cavity were mostly found in levels IA, IB, II and III while nodes from carcinoma larynx and oropharynx were mainly seen in levels II, III and IV. The malignant tumors revealed ill-defined margins, heterogeneous enhancement with invasion of adjacent fat and fascial planes. Contrast enhanced computed tomography of neck gives anatomical extent, characterization of malignant neck masses and cervical nodal spread.

**Keywords:** Neck masses, computed tomography, malignancy.

## INTRODUCTION

Clinical examination of neck is limited in its ability to accurately assess the extent and size of lesion and nodal involvement. Radiological examination has been relied upon for many years in establishing the most probable etiology of neck swelling and assisting surgeons to plan proper surgical management. Computed tomography permits precise anatomical localization, extent of the masses and allows differentiation of solid, cystic and mixed masses.

Computed tomography with intravenous contrast enhancement is a sensitive and reliable modality for evaluation of vascular structures and soft tissue of the neck. We evaluated CT findings of proven malignant neck masses in 59 patients over a period of two years at a tertiary referral center.

## MATERIALS AND METHODS

With permission of Institutional Ethical Committee, present study was carried out in 59 patients with histopathological proven malignant neck masses between December 2014 and November 2016 at Government Medical College, Aurangabad. All patients underwent contrast enhanced CT at our department on GE LIGHT SPEED VCT (VOLUME CT) SCANNER 64 SLICE CT. Patients with history of trauma, deranged renal function test, sensitivity to iodinated contrast media and histopathology proven benign lesions were excluded. Written informed consent was obtained in all patients.

Puffed cheek technique was used in suspected cases of carcinoma of buccal mucosa whereas Valsalva's maneuver with phonation was used to distend pyriform sinuses when indicated. Scout film taken in supine (AP) position covering superiorly from mid orbit to inferiorly till clavicle is taken, followed by plain scan. 50 ml of Non ionic IV contrast was given containing iodine 350 mg/ml, injected at the rate of 2-2.5 ml/sec with delay of 27-32 sec using pressure

injector at a pressure of 250 mm of Hg. Slice thickness of 3-5mm, collimation level at 64x0.625 mm and pitch at 1-1.5 were maintained with rotation time of scan 0.5 sec and field of view 25-30. Reconstruction interval was kept at 2.5 sec. Value of kVp 120, mAs 225 were used with window setting of 350/50 (WW/WL) for soft tissues and 3500/400 (WW/WL) for bone.

## RESULTS

The present study was carried out in 59 cases of histopathologically proven malignant neck masses. Commonest age group was 51-60 years (26 cases) and only 12 patients presented below the age of 50. Distribution of malignant neck masses is shown in Table-1 and Table-2 shows CT characteristics of malignant neck masses. Heterogenous enhancement was predominant feature in 90% of cases, whereas necrosis was observed in 66%. The most common malignant neck mass was metastatic lymphadenopathy from aerodigestive tract (24/45), followed by thyroid malignancy (10/45) and lymphoma (6/45). Table-3 shows malignant nodal neck masses.

**Table-1: Distribution of malignant neck masses**

| | **Malignancy** | **Total Patients** |
|---|---|---|
| 1 | Metastatic aerodigestive tract malignancy<br>Carcinoma Larynx (10)<br>Carcinoma oral cavity (8)<br>Carcinoma oropharynx (1)<br>Carcinoma palatine tonsil (1)<br>Carcinoma nasopharynx (1)<br>Carcinoma cervical esophagus (3) | 24 |
| 2 | Metastatic node of unknown primary | 10 |
| 3 | Metastatic node of carcinoma thyroid | 2 |
| 4 | Lymphoma | 6 |
| 5 | Thyroid malignancy | 10 |
| 6 | Salivary gland malignancy | 7 |
| | **Total** | 59 |

**Table-2: CT Characteristics of malignant neck masses (n=59)**

| **Neck Lesions** | **MALIGNANT LESION** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Enhanc-ement** | | **Necrosis** | | **Bony Necrosis** | | **Vascular invasion** | | **Adjacent space invasion** | |
| | Homogenous | Heterogenous | Negative | positive | Absent | Present | Absent | Present | Absent | Present |
| **Metastatic aerodigestive tract malignancy (24)** | 0 | 24 | 7 | 17 | 20 | 4 | 22 | 2 | 2 | 22 |
| **Metastatic nodes of unknown primary (10)** | 0 | 10 | 1 | 9 | 10 | 0 | 8 | 2 | 0 | 10 |
| **Lymphoma (6)** | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 4 | 2 |
| **Thyroid malignancy (12)** | | | | | | | | | | |
| **Papillary carcinoma (7)** | 0 | 7 | 2 | 5 | 7 | 0 | 6 | 1 | 1 | 6 |
| **Follicular carcinoma (3)** | 0 | 3 | 1 | 2 | 3 | 0 | 1 | 2 | 2 | 1 |
| **Metastatic nodes (2)** | 0 | 2 | 1 | 1 | 2 | 0 | 2 | 0 | 2 | 0 |
| **Salivary gland malignancy** | | | | | | | | | | |
| **a) Parotid gland** | | | | | | | | | | |
| Adenoid cystic Ca (1) | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| Mucoepidermoid Ca (3) | 0 | 3 | 1 | 2 | 3 | 0 | 3 | 0 | 0 | 3 |
| **b) Submandibular gland** | | | | | | | | | | |
| Mucoepidermoid Ca (3) | 0 | 3 | 1 | 2 | 2 | 1 | 3 | 0 | 0 | 3 |
| **Subtotal** | 6 | 53 | 21 | 38 | 53 | 6 | 52 | 7 | 11 | 48 |
| **Total** | **59** | | **59** | | **59** | | **59** | | **59** | |

**Table-3: Malignant nodal neck masses**

| Sr. No. | Nodal Mass | No. of Cases(n) | Percentage |
|---|---|---|---|
| 1 | Metastatic aero digestive tract malignancy | 24 | 57 |
| | Ca larynx | 10 | 25 |
| | Ca oral cavity (buccal mucosa, soft palate, tongue) | 8 | 19 |
| | Ca oropharynx | 1 | 2 |
| | Ca palatine tonsil | 1 | 2 |
| | Ca nasopharynx | 1 | 2 |
| | Ca cervical esophagus | 3 | 7 |
| 2 | Nodal metastasis from unknown primary | 10 | 24 |
| 3 | Ca thyroid | 2 | 5 |
| 4 | Lymphoma | 6 | 14 |
| **Total** | | **42** | **100** |

## DISCUSSIONS

Computed tomography has found increasing application in the evaluation of patients with malignant neck mass lesions (1-14). It is non invasive, non-operator dependent and permits the accurate measurement of tissue attenuation coefficient. CECT has improved the examination quality with lower radiation doses [5]. Excellent three dimensional reconstruction is possible using volume rendering, maximum intensity projection and shaded surface display techniques, which facilitate the surgeon to understand the anatomical extent of the lesion and its relationship with surrounding structures in much better way. Histopathological diagnosis may be suggested on CT by noting the location and characteristic features of malignant lesions [6].

We observed male preponderance, which could be attributed to smoking and alcohol addiction [7]. The predominant malignant neck mass in the present study was metastases from aerodigestive tract. Of these carcinoma larynx contributed total 10 cases. Our study shows higher incidence of carcinoma larynx, followed by thyroid carcinoma, lymphoma and salivary gland malignancy. Similar observations were made by previous researchers [8].

The metastatic lymph nodal deposits from aerodigestive tract were attributed to larynx, oral cavity, nasopharynx and cervical esophagus in descending order (Table-3). Level IA, IB, II and III were the most commonly involved lymph nodes in oral cavity primaries whereas level II, III and IV were commonly involved in carcinoma larynx and oropharynx. These observations are comparable with previous studies [9].

All of the laryngeal malignancies were found to be squamous cell carcinomas with most common metastatic lymph nodal involvement at level II, III and IV. Paraglottic extension with thyroid cartilage invasion is important in staging (Figure-1).

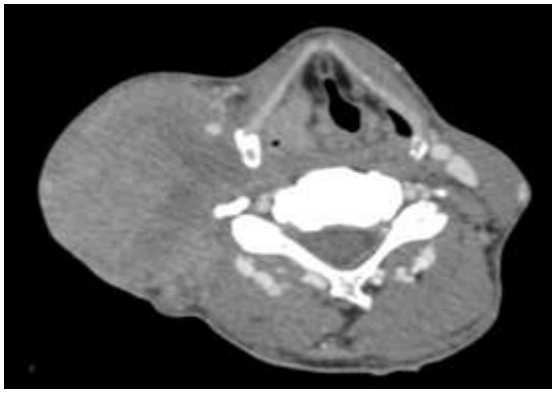

**Fig-1: Partially necrotic right cervical nodal mass with carcinoma supraglottis as primary**

Puffed cheek technique was applied in suspected cases of carcinoma buccal mucosa. Care should be taken to evaluate the invasion of masticator space, pterygomandibular raphe and retromolar trigone. Osseous invasion of mandible or maxilla requires bone resection. Attention should be paid for the involvement of inferior alveolar nerve (Figure-2).

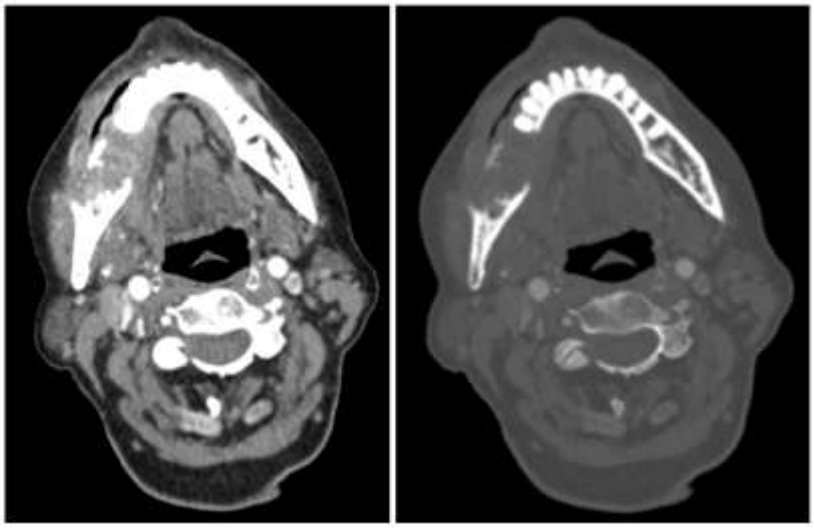

**Fig-2: Heterogeneously enhancing thickening of right buccal mucosa with erosive destruction of adjacent body of mandible**

Oral tongue squamous cell carcinomas were found to be associated with alcohol and tobacco use. Clinical examination can assess only mucosal involvement. CECT is required to asses deep extent and nodal involvement. Oral tongue squamous cell carcinomas most often arise from lateral border of tongue (Figure 3), followed by base of tongue. Involvement of extrinsic muscles suggest T4a staging seen as loss of fat plane between these muscles. Evaluating exact extension of tumor is important as margins of 1.5 to 2 cm are required to minimize recurrence. Spread to contralateral side precludes hemiglossectomy [12].

**Fig-3: Heterogeneously enhancing thickening of right lateral border of tongue with necrotic conglomerated metastatic cervical nodal mass**

Among ten cases of thyroid gland malignancy, seven were papillary carcinoma and three were follicular carcinoma. Multifocal and bilateral involvement was observed in papillary carcinoma of thyroid (Figure-4), which showed heterogenous enhancement, nodal metastases and calcification. In preoperative staging of thyroid cancer the concern for CT evaluation is assessment of local invasion and mediastinal extension that may change surgical approach or preclude curative surgery [13, 14].

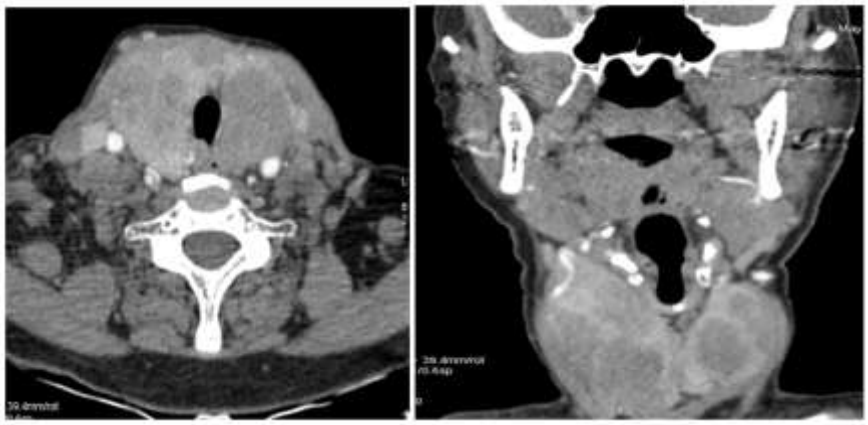

**Fig-4: Papillary carcinoma thyroid showing bilateral multifocal heterogenously enhancing lesions with cervical lymphadenopathy**

Among salivary gland malignancies, most common were from parotid gland, three mucoepidermoid carcinomas and one adenocystic carcinoma. CT revealed ill defined margins, heterogenous enhancement and invasion of adjacent fat and fascial planes. Because of well defined margins one mucoepidermoid carcinoma was misdiagnosed as Warthin's tumor. This is comparable with similar observation done by Bryan et al who reported that by CT, all the benign lesions were correctly identified as benign, however 17% of malignant lesions were incorrectly considered to be benign [10].

Among 42 malignant nodal neck masses most common were metastases from aerodigestive tract (24 cases), followed by metastasis from unknown primary, thyroid and lymphoma. CT showed ill-defined margins, central non enhancing necrosis and calcifications in few cases. In six cases of lymphoma (Figure-5), CT showed enlarged, discrete, non necrotic lymph nodes with homogenous enhancement and involvement of Waldeyer's ring in one. Findings were similar with previous literature [2, 3]. This observation correlates with the study of Choi JW *et al*., in 2006 [3], which states that lymphomatous nodes are rarely necrotized and the presence of necrosis indicates high grade lymphoma.

**Fig-5: Homogeneously enhancing non necrotic discrete lymph nodes involving bilateral posterior cervical space (left>right) and axilla (right>left), in a known case of lymphoma**

CT correctly differentiates benign and malignant lymph nodes. The criteria for metastatic disease include the size (short axis diameter should not exceed 11 mm in level II nodes and should not exceed 10 mm at nodes elsewhere in the neck) and shape (loss of normal oval shape), abnormality of the internal architecture (loss of normal central fatty hilum), including nodal necrosis, and extracapsular tumor spread (indicated by indistinct nodal margins, irregular nodal capsular enhancement, or infiltration in the adjacent fat or muscle [11]. However CT neck may have diagnostic fallacies. The homogenous enhancement observed in subcentimeter sized lymph nodes in malignancy may be misdiagnosed as benign whereas in tubercular lymphadenopathy heterogenous enhancement with central necrosis may be wrongly diagnosed as malignant lymph node. This observation is comparable with the study of Greene F *et al*., which states that no imaging modality is 100% specific to distinguish between reactive and malignant lymph nodes, histopathological examination is necessary to exclude tumor cells [1].

In present study 58 out of 59 malignant neck lesions were correctly diagnosed by contrast enhanced CT, giving an accuracy of 98%. Similar results were

obtained by previous authors [4]. CT helps in localising the lesion, delineates the extent and thus helps in staging of the malignancy.

## CONCLUSION

Contrast enhanced computed tomography of neck has improved the localisation, anatomical extent and characterization of neck masses. The epicenter of neck mass is easily detected on CECT neck based on the morphology, enhancement pattern and neck space involved by the malignant neck masses. It is very useful non-invasive tool in evaluating various neck masses and assessing cervical nodal spread. The detection of vascular invasion, bony invasion and extension of neck mass into adjacent neck space guide the surgeon for appropriate surgical approach.

Careful analysis of CECT imaging features of a neck mass in combination with appropriate clinical history produce a reasonably correct diagnosis in most cases. It provides road map for surgeons and clinicians. With the advantages of faster scan acquisition, improved vascular contrast enhancement, increased detection of pathologies and multiplanar three dimensional reconstructions, CECT should be the imaging modality of choice in the evaluation of malignant neck masses.

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