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## Evaluation of neck masses by CT or MRI

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**Abstract**---Aim: To evaluate the role of CT or MRI in neck masses for pre-operative characterization based on location, extent, morphological characteristics and enhancement pattern. Materials & methods: The present study was conducted in the department of Radiodiagnosis in co-ordination with the departments of E.N.T and Pathology at K.E.M. Hospital, Mumbai. A total of 50 (25 each of CT and MRI) patients with palpable neck masses were included. Results: The study comprised of nodal and non-nodal masses. Out of 50 cases studied, 23 cases (46%) had benign lesions and 27 (54%) cases had malignant lesions. The overall male to female ratio was 0.85:1. MRI and CT made a correct diagnosis in 48 out of 50 cases, having a diagnostic accuracy of 96%. For evaluation of neck masses by CT or MRI, the sensitivity, specificity, positive predictive value and negative predictive value are 96.30%, 95.65%, 96.30% and 95.65% respectively. Conclusion: CT and MRI ensure accurate anatomical localization and lesion characterization in benign lesions. MRI has obvious advantages over CT in neck imaging like better soft tissue resolution, lack of ionizing radiation and safer contrast agents. By comparison CT examinations offer the advantages of superior assessment of osseous integrity, shorter examination time, wider patient access and lower cost.

**Keywords**---neck masses, computed tomography, magnetic resonance imaging.

## Introduction

The neck is a wide anatomical area extending from the mandible superiorly to the manubrium sterni and clavicles inferiorly, laterally bounded by anterior border of trapezius muscles on both sides. It encompasses a wide variety of anatomical structures which belong to different organ systems and thus the swellings in neck can be caused by innumerable pathological lesions arising from the various anatomical structures lying there in. The masses in the neck show a wide range of origin and can be congenital or acquired, inflammatory, vascular or neoplastic. The neck being an exposed area, the swellings there are easily observed and thus lead to a cosmetic problem, leading to an early presentation of the patients to clinicians, early diagnosis and treatment. Mostly benign, neck masses can be malignant sometimes and may occasionally lead to fatal complications like airway compression, vascular compromise or metastatic spread of the lesion.

The development of modern cross-sectional imaging techniques has substantially altered the treatment and management of malignancies of upper aero-digestive tract. Important decisions that were once made during surgery are now being made in advance of surgery by using information from Computed Tomography (CT) and MRI. Cross-sectional imaging provides detailed information about the extent and depth of tumors, information that often cannot be ascertained by physical examination alone. Imaging helps determine tumor resectability and the extent of surrounding tissue that must be resected to ensure adequate surgical margins. Because it improves the accuracy of staging, pre-treatment imaging is accepted as an important adjunct to physical examination in patients with malignancies of upper aero-digestive tract. Post surgical and post radiation surveillance imaging are now widely regarded as mainstay of patient follow up.

Current imaging with high-resolution helical computed tomography and multiplanar reformations and MR imaging permit a detailed analysis of the complex anatomy in this region and is the key to understanding many of its disorders including mass lesions. Through such understanding we can recognize the issues involved in conservative neck surgery, neck nodal texture and functional assessment, brachial plexopathy, and the treated neck, appreciate the relevant surgical anatomy of the spaces in the neck, and relate better with our ENT colleagues.

High-resolution computed tomography (CT) and magnetic resonance imaging (MRI) have proved to be invaluable tools for evaluating the soft tissue structures of the neck. The combination of soft tissue characterization and anatomical localization afforded by CT and MRI allows radiologists to make a substantial contribution to the preoperative assessment of the patient with a neck mass. Although an exact tissue diagnosis is may not always be possible, careful analysis of the imaging features of a neck mass in combination with clinical history and physical examination produce a reasonably short differential diagnosis in nearly every case. <sup>(1)</sup> For large, deep-seated lesions assessment using CT or MRI often provides useful supplementary information. <sup>2</sup> So, considering all these backgrounds, we have taken a humble attempt for the present study "Evaluation of neck masses by CT or MRI" in the department of Radiology, KEM hospital, Mumbai.

## **Aims & Objectives**

- To evaluate the role of CT or MRI in neck masses for pre-operative characterization based on location, extent, morphological characteristics and enhancement pattern.
- Outlining the extent in terms of involvement of adjacent structures, vessels and possible adenopathy.
- Surgical and Histopathological correlation whenever possible.

## **Methods and Materials**

After getting an approval of the institutional ethics committee, a non-interventional cross sectional observational study was conducted in the department of radiology, at Seth G.S. Medical College and K.E.M. Hospital, Parel, Mumbai, for a period of 10 months. The sample size was 50 patients of neck masses. 25 patients of CT and 25 patients of MRI.

## **Inclusion criteria**

All the patients who are undergoing contrast enhanced CT scan or contrast enhanced MRI scan, as advised by the respective physician and are diagnosed as palpable neck swelling and willing to participate into the study fulfilling the below mentioned criteria-

- Any sex, male or female.
- Patients having normal serum creatinine value (0.3-1.4 mg/dl).
- Patients non-allergic to contrast.
- Patient having registration at this institute.

## **Exclusion criteria**

- Any patient not willing for the study.
- Any patient having increased serum creatinine levels (>1.4 mg/dl)
- Any pregnant female patient.
- Any patient having history of contrast allergy reaction.
- Post operative patients
- Contraindication for MRI-cardiac pacemaker, metallic stents and grafts, cochlear implant, pregnant female etc.

## **Study procedure**

Proper informed consent will be taken from patient after explaining to them about the risk and benefits of examination. Essential clinical history will be obtained mainly regarding neck mass. The serum creatinine value of patient will be checked. All studies will be performed on CT-Philips 64 slice Brilliance Computed tomography scanner and CT data.

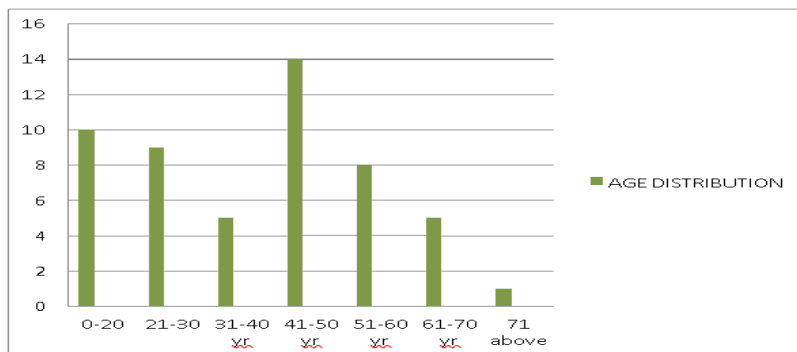
An age based standard low dose [Kv-120Mas/slice-220] CT protocol will be used. Standard contrast enhanced neck scanning protocol includes plain phase and

venous phase. Plain scan will include from base of skull to superior mediastinum. Followed by 1.5 ml/kg non-ionic iodinated contrast material will be injected at rate of 3ml/sec using pressure injector, venous phase scanning will include the same area. All the image data will be sent electronically to a workstation [Philips Tera-recon] for analysis. MRI- Multi-echo Multiplanar MR brain will be performed on Sonata Magnetom 1.5T MR scanner from Siemens with gradient field strength of 40 mT/m<sup>2</sup> using standard protocols.

## Results

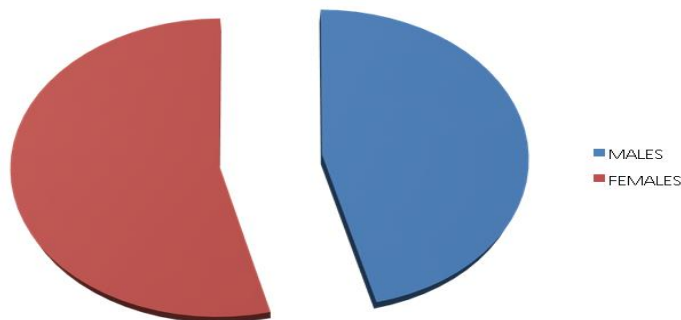
The study comprised of nodal and non-nodal masses Out of 50 cases studied, 23 cases (46%) had benign lesions and 27 (54%) cases had malignant lesions.

Graph 1 Age Distribution



- Age of the patients included in the study ranged from 5 months-85 years.
- Maximum numbers of patients were in the age group 41-50 years. (28%)
- Minimum numbers of patients were in the age group 71 and above years. (2%)

Graph 2 Sex Distribution



Out of the 50 patients included in the study, 23 (46%) were males and 27 (54%) were females. The overall male to female ratio was 0.85:1

Table 1 Clinical Complaints

COMPLAINTS	NUMBER
1) SWELLING	50
2) PAIN	23
3) HOARSENESS	5
4) DYSPHAGIA	6
5) FEVER	9

\*One patient may have more than one complaint.

- All patients presented with swelling.
- Pain was associated with swelling in 46% of the cases.
- Fever, hoarseness and dysphagia were other associated symptoms

Table 2 Clinical Diagnosis Vs Final Diagnosis

Final diagnosis(n=35)	No. of cases	Clinical diagnosis(n=35)		
		Same	Different	Indeterminate
<b>Nodal masses (n=23)</b>				
Tubercular adenopathy	2	2	-	-
Laryngeal carcinoma with nodal metastases	2	2	-	-
Oral and Oropharyngeal carcinoma with nodal Metastases	14	14	-	-
Metastases with unknown primary	2	1	1(parotid mass)	-
Lymphoma	3	2	-	1(infective lesion)
<b>Non nodal masses (n=27)</b>				
<b>Salivary gland lesions</b>				
Parotid tuberculosis	1	-	1(pleomorphic adenoma)	-
Pleomorphic adenoma	4	3	-	1(parotitis)
Calculus induced sialadenitis	1	-	1(pleomorphic adenoma)	-
Ranula	1	1	-	-
Adeno carcinoma	1	1	-	-
High grade malignancy of submandibular gland	1	1	-	-
<b>Masses of developmental origin</b>				
Lymphangioma	1	1	-	1(cystic lesion)
Thyroglossal cyst	1	-	1(goitre)	-
Branchial cleft cyst	2	2	-	-
<b>Thyroid masses</b>				
Multinodular goiter	1	1	-	-

Medullary carcinoma of thyroid	1	-	1 (goitre)	-
Follicular carcinoma of thyroid	1	1	-	-
Papillary carcinoma of thyroid	1	1	-	-
Masses of neurogenic Origin				
Vagal schwannoma	3	3	-	-
Carotid body paraganglioma	1	1	-	-
Masses of vascular origin				
Hemangioma	1	1	-	-
Venolymphatic malformations	1	1	-	-
Masses of mesenchymal origin				
Lipoma	1	1	-	-
Hypopharyngeal mesenchymal tumour	1	1	Benign lesion	-
Inflammatory masses				
Abscess	2	2	-	-
Total	50	41	6	3

Clinical diagnosis was in agreement with final diagnosis in 41 (82%) out of 50 cases.

Table 3 Final Diagnosis Vs CT Diagnosis or MRI Diagnosis

Final diagnosis(n=35)	Total cases	CT Diagnosis		MRI Diagnosis	
		Same	Different	same	Different
Nodal masses (n=23)					
Tubercular Adenopathy	2	1		1	
Laryngeal carcinoma with Nodal Metastases	2	2			
Oral and Oropharyngeal carcinoma with nodal Metastases	14	6		8	
Metastases with unknown Primary	2	2			
Lymphoma	3	2	1		
Non Nodal Masses(n=27)					
Salivary gland lesions					
Parotid tb	1	1			
Pleomorphic	4			3	1
Calculus Induced Sialadenitis	1			1	
Adeno Carcinoma	1			1	
Ranula	1			1	
High grade malignancy of submandibular gland	1	1			
Masses of developmental Origin					

Lymphangioma	1	1			
Thyroglossal cyst	1			1	
Branchial Cleft Cyst	2	1		1	
Thyroid masses					
Multinodular goiter	1	1			
Medullary carcinoma of thyroid	1	1			
Papillary carcinoma of thyroid	1		1		
Follicular carcinoma of thyroid	1	1			
Masses of Neurogenic Origin					
Vagal Schwannoma	3	1		2	
Carotid Paraganglioma	1	1			
Masses of vascular origin	1			1	
Hemangioma	1			1	
Venolymphatic malformation	1	1			
Masses of Mesenchymal Origin					
Lipoma	1			1	
Hypopharyngeal mesenchymal tumour	1			1	
Inflammatory Masses					
Abscess	2	1		1	
Total	50	24	1	24	1

CT and MRI made a correct diagnosis in 48 out of 50 cases, having a diagnostic accuracy of 98%.

Imaging Feature on CT and MRI	No. of cases
Hemorrhage	1
Necrosis	2
Calcification	1
Thyroid capsule Invasion	2
Vascular invasion	0
Aero-Digestive tract invasion	0

- It was not possible to differentiate benign from malignant lesions on CT and MRI.
- 1 case of papillary carcinoma was diagnosed as multinodular goiter.
- Both CT and MRI were useful in evaluating the extent of the lesions.
- All patients underwent total thyroidectomy and were put on eltroxin.

### Nodal masses

Table 4 Etiology of Nodal Masses

Etiology	No. of cases	Percentage
1) Metastatic aero digestive malignancy	16	69.60%
2) Nodal metastases with unknown primary	2	8.70%
3) Lymphoma	3	13.00%
4) Tubercular adenopathy	2	8.70%

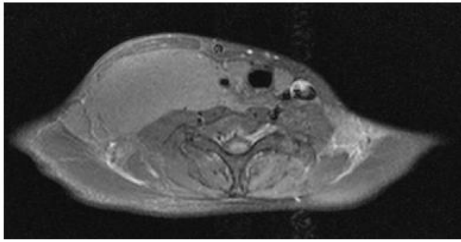


Fig-A

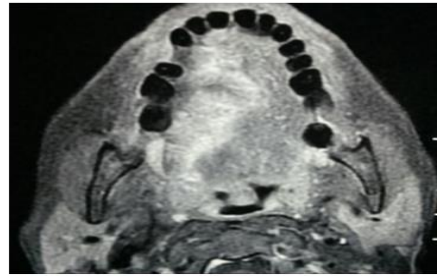


Fig-B

### **Non hodgkins lymphoma**

Fig A. Post contrast axial T1WI FS MRI showing homogenous enhancing lymphadenopathy with vessel encasement and mediastinal extension

### **Carcinoma of anterior 2/3 RD of tongue**

Fig B. Post contrast axial T1WI FS MRI showing heterogeneously enhancing mass in right anterior 2/3 rd of tongue crossing midline with extension to right gingiva-buccal sulcus.

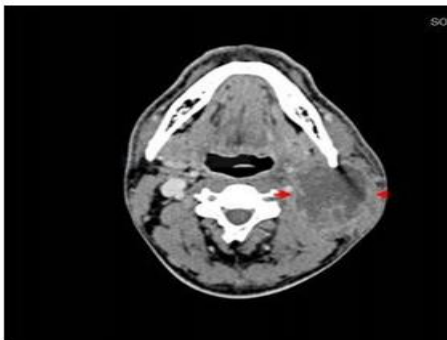


Fig-A

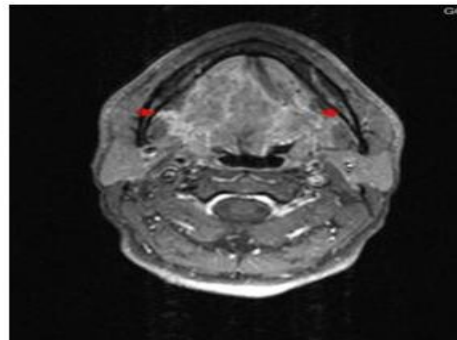


Fig-B

### **TB lymphadenopathy**

Fig A. CECT show enlarged peripherally enhancing lymph node along the upper jugular chain on the left side with inflammation of the surrounding soft tissue.

### **Carcinoma of base of tongue**

Fig B. Post contrast T1WI sequences show an ill-defined heterogeneously enhancing mass lesion involving the base and lateral border of the tongue on the right side crossing the midline and also extending to the vallecula.



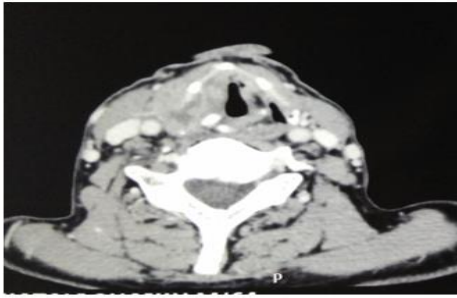


Fig-A

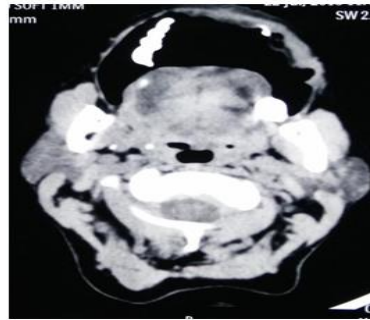


Fig-B

### **Supraglottic carcinoma**

Fig A. Axial CECT showing supraglottic enhancing mass with invasion of the thyroid cartilage with nodal metastases.

### **Left GBS carcinoma**

Fig B. Axial CECT showing left thickened ulcerated buccal mucosa

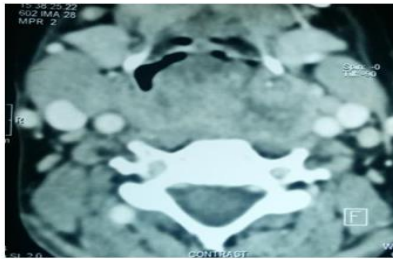


Fig-A

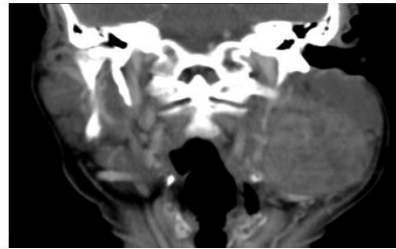


Fig-B

### **Postcricoid carcinoma with nodal metastases**

Fig A. Axial CECT showing enhancing large postcricoid mass.

### **Metastases from unknown primary**

Fig B. Coronal CECT Showing heterogeneously enhancing lymphadenopathy

**Salivary gland lesions**

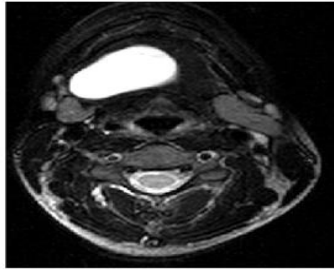


Fig-A

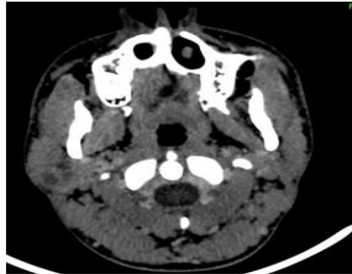


Fig-B

**Ranula**

Fig A. T2 weighted axial MRI showing a cystic lesion in the sublingual space.

**Parotid TB**

Fig B. CECT axial showing multiple nonenhancing hypodense lesion in the right parotid gland.

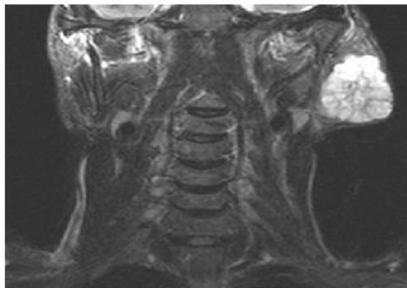


Fig-A

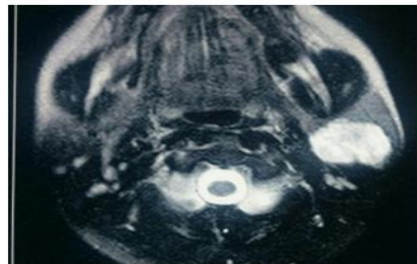


Fig-B

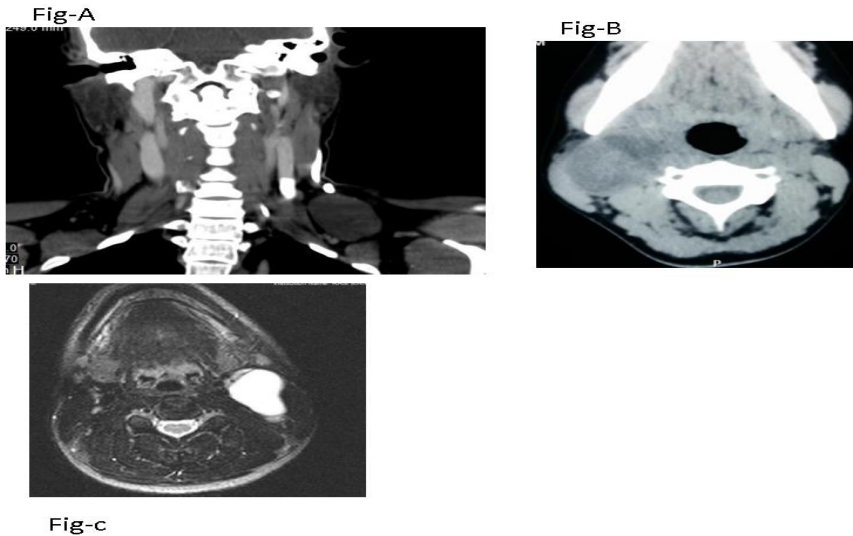
**Adeno carcinoma of the parotid**

Fig A. T2 weighted FS coronal MRI showing a mass lesion in the left parotid.

**Pleomorphic adenoma**

Fig B. T2 weighted axial MRI showing a mass lesion in the left parotid

### Masses of developmental origin



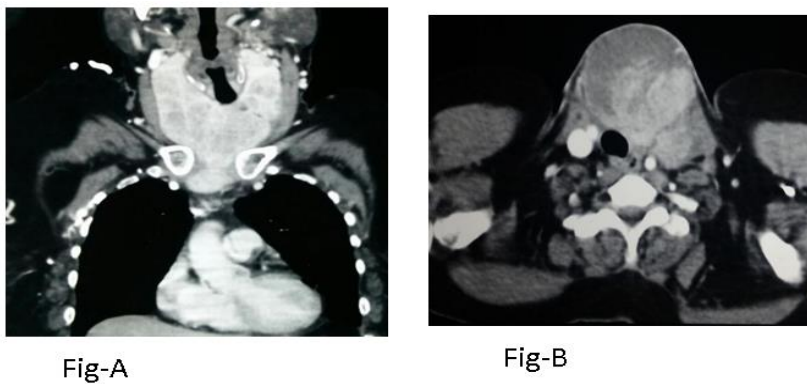
### Lymphangioma

Fig A Coronal CECT a unilocular cystic lesion.

### Second branchial CYST

Fig B. Axial CECT Fig C. Axial T2 WI FS showing a cystic lesion anteromedial to the sternocleidomastoid and posterolateral to the submandibular gland with thickened enhancing wall.

### Thyroid masses



### Multinodular goitre

Fig A. coronal CECT showing bilateral enlarged thyroid lobes with retrosternal extension.

### **Papillary carcinoma thyroid**

Fig B. axial CECT showing heterogeneously enhancing solid cystic lesion in left thyroid lobe.

### **Masses of neurogenic origin**

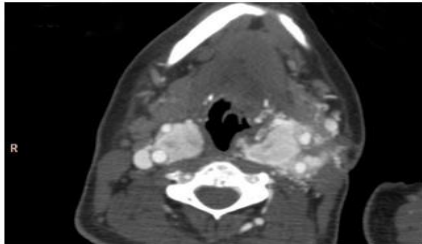


Fig-A

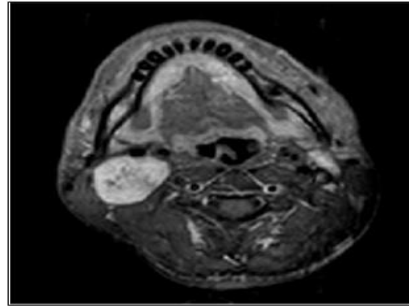


Fig-B

### **Bilateral paraganglioma**

Fig: A. Axial CECT showing bilateral paraganglioma in carotid space displacing the internal and external carotid arteries laterally without splaying them.

### **Vagal schwannoma**

Fig: B. Post contrast T1 FS axial MRI showing vagal schwannoma in the post styloid parapharyngeal space displacing the internal and external carotid arteries anteriorly and medially without splaying them

### **Masses of vascular origin**

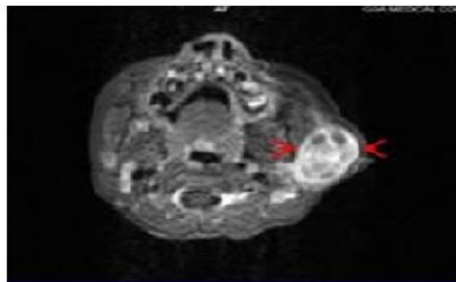


Fig-A

### **Hemangioma**

Fig A. Post Contrast T1WI sequence showing an intensely enhancing mass lesion in the left parotid gland.

### Mesenchymal masses

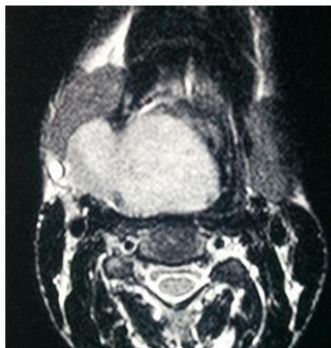


Fig-A

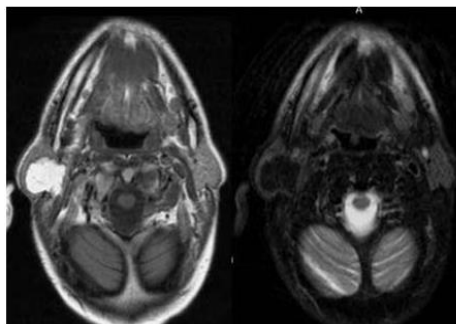


Fig-B

### Hypopharyngeal synovial sarcoma

Fig A. axial post contrast FS T1 images showing homogeneously enhancing mass.

### Parotid lipoma

Fig B. Axial T1 and FS T2 showing hyperintense mass suppressed on FS images

### Inflammatory masses



Fig-A

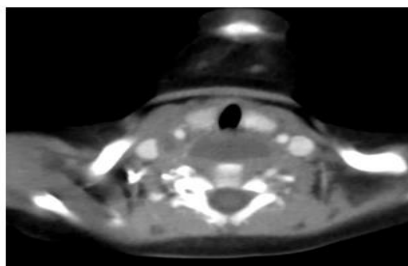


Fig-B

### Retropharyngeal abscess

Fig A. coronal CECT and B axial CECT images showing peripherally enhancing retropharyngeal abscess.

### Statistics

A = True positive (patients having CT/MRI diagnosis of malignant neck mass and histopathology tests are suggestive of same) =26

B = False positive (patients having CT/MRI diagnosis of malignant neck mass and histopathology tests are suggestive of benign etiology) =1

C = False negative (patients having CT/MRI diagnosis of benign neck mass and histopathology tests are suggestive of malignant neck mass) =1

D = True negative (patients having CT/MRI diagnosis of benign neck mass and histopathology tests are suggestive of same) =22

- Sensitivity =  $A/A+C \times 100 = 26/27 \times 100 = 96.30\%$
- Specificity =  $D/B+D \times 100 = 22/23 \times 100 = 95.65\%$
- Positive Predictive Value=  $A/A+B \times 100 = 27/25 \times 100 = 96.30\%$  Negative Predictive Value=  $D/C+D \times 100 = 22/23 \times 100 = 95.65\%$
- Diagnostic Accuracy =  $A+D/\text{Total number of cases (histopathologically diagnosed)} \times 100$ .

$$= 48/50 \times 100 = 96 \%$$

## Discussion

Imaging plays a major role in diagnosis and planning the treatment in patients with neck masses. The radiologist must have a thorough knowledge of the modalities and techniques available to select the most efficient imaging protocol to solve the diagnostic problem. 50 patients with clinically palpable neck masses were evaluated using MRI and CECT and the masses were characterized based on location, morphological characteristics and enhancement pattern. The extent was outlined in terms of involvement of adjacent structures, vessels and lymphadenopathy. Cytological, histopathological and/or surgical details were noted to achieve the final diagnosis.

Age of the patients included in the present study ranged from 5 months-85 years. Maximum number of patients were in the age group 41-50 years. The overall male to female ratio was 0.85:1. All patients presented with neck swelling. Pain was the most common symptom associated with swelling. Fever, hoarseness and dysphagia were other associated symptoms. The study comprised of nodal and non-nodal masses out of 50 cases studied, 23 cases (46%) had benign lesions and 27 (54%) cases had malignant lesions. Clinical diagnosis was in agreement with the final diagnosis in 41 (82%) of 50 cases. CT made a correct diagnosis in 24 out of 25 cases, having a diagnostic accuracy of 98%. MRI made a correct diagnosis in 24 out of 25 cases, having a diagnostic accuracy of 98%. MRI and CT made a correct diagnosis in 48 out of 50 cases, having a diagnostic accuracy of 96%.

## Nodal masses

Nodal masses were the most common masses encountered and constituted 46% of the total number of cases. These included nodal metastases from aero digestive malignancies (69.6%), nodal metastases with unknown primary (8.7%), lymphoma (13%) and tubercular adenopathy (8.7%). Out of 23 nodal masses, 21 were malignant (91.3%) and 2 was benign (8.7%).

### **Metastatic adenopathy**

We observed 18 cases of metastatic lymphadenopathy. All the nodal masses were histopathologically proven to be cases of squamous cell carcinoma of different grades. In 16 cases the primary site was the aerodigestive tract. Out of these 16, 14 cases had oral and oropharyngeal carcinoma and in 2 cases larynx was the primary site. 2 cases were labelled as nodal metastases from unknown primary as the primary site could not be delineated even after detailed clinical examination and investigations. The nodal metastases were assessed in terms of location in relation to the Imaging Based Nodal levels as proposed by Som P, Curtin H et al<sup>3</sup> and nodal size (short axis diameter), number, echo pattern, features of necrosis, enhancement pattern, conglomeration, extra nodal spread, calcification and vascular invasion.

### **Nodal size**

In our study metastasis was suspected when a lymph node was greater than 1.5 cm in maximum diameter either in the jugulodigastric region (level II) or in the submandibular triangle (level I) or, when a node was greater than 10 mm (1 cm) in greatest diameter elsewhere in the neck.

### **Central nodal necrosis**

On USG metastatic node is seen as hypoechoic, round and without echogenic hilus. Intranodal necrosis appears as demarcated echogenic focus and is not continuous with adjacent soft tissues. According to King Ad et al<sup>(4)</sup> necrosis on CT was defined as a focal area of low attenuation with or without a surrounding rim of enhancement. They also concluded that MR imaging is comparable to CT for the detection of necrosis. We used the same criteria to determine necrosis. Necrosis was seen on MRI and CT in total of 10 cases.

### **Extranodal spread**

The presence of extra nodal tumour extension was identified as an irregular nodal margin with infiltration around and obliteration of the adjacent fat planes in our study. We detected extra nodal tumour extension spread in 7 cases both on both USG and CT. King AD et al<sup>(4)</sup> in their study concluded that there was no significant difference between CT and MR for either sensitivity or specificity for the detection of extra-nodal spread.

### **Arterial invasion**

Vessel wall invasion was suggested when more than 270 degree of the arterial circumference was surrounded by the tumour and was seen in no cases on the basis of criteria suggested by Yousem et al.<sup>5</sup>

### **Evaluation of primary lesion**

In 14 out of the 16 cases oral cavity and oropharynx was the primary site. Of these 3 cases were tongue base masses, 5 were anterior 2/3 tongue masses, 5

were gingivobuccal mucosal masses and 1 pyriform fossa mass. The extent of the lesions was defined and any additional findings like bone erosion, prevertebral muscle invasion and involvement of adjacent spaces were noted. In 2 cases of larynx was the primary site. Both the lesions show transglottic spread with invasion of the thyroid cartilage. In 2 cases the primary site could not be delineated even after detailed clinical examination and imaging evaluation.

### **Lymphoma**

2 cases were diagnosed as Non-Hodgkin's lymphoma and 1 case as Hodgkin's lymphoma. All 3 cases showed multiple lymph nodes involving multiple levels on MRI and CT and the lymph nodes were homogeneously enhancing. 2 cases with non-Hodgkin's lymphoma had associated mediastinal lymphadenopathy. One of them showed pleural effusion. One case of Non-Hodgkin's lymphoma showed marrow signal intensity changes in multiple cervical and thoracic vertebrae suggestive of lymphomatous involvement. Lee YY et al<sup>6</sup> described neck nodal involvement in Hodgkin's and Non-Hodgkin's lymphoma, as involvement of multiple deep chain lymph nodes which can be unilateral or bilateral and of varying sizes. Nodal necrosis was found in 5% with Hodgkin's disease and 13% with non-Hodgkin's lymphoma, even with extensive disease in their study.

### **Tubercular adenopathy**

2 cases of tubercular adenopathy with bilateral cervical lymphadenopathy and parenchymal lesion on Chest X ray. On MRI and CT, the tubercular lymph nodes (1 case) had the appearance of bilateral conglomerate nodal mass with rim enhancement (on CT) and preservation of fascial planes around them. Necrotic mediastinal nodes with left lobe consolidation were seen in the chest. These findings were in accordance with those described by Vaid S et al<sup>(7)</sup>

### **Non nodal masses**

Non nodal masses constituted approximately 54 % of the lesions and included salivary gland lesions (18%), thyroid masses (8%), masses of developmental origin (8%), masses of neurogenic (8%), vascular (4%), mesenchymal origin (4%), and inflammatory masses (4%). Out of 27 non nodal masses 6 cases were malignant (22.2%) and 21 were benign (77.8%).

### **Salivary gland lesions**

9 cases (18) of salivary gland pathology were observed in the present study which comprised of tumours (6 cases), calculus induced sialadenitis (1 case) infections (1 cases) and ranula (1 case). 6 cases were diagnosed as tumors. All cases were seen involving the major salivary glands. 4 of these were benign. 4 out of the 6 (66.66%) were diagnosed to be pleomorphic adenomas. Yousem et al<sup>8</sup> observed that nearly 80% of benign parotid neoplasms are pleomorphic adenomas. They also mentioned that pleomorphic adenomas occur most commonly in middle-aged women. However in our study all cases were males. This could be because of variation in demographic factors.



2 of the cases were seen involving the superficial lobe of the parotid gland which has been reported to be the most common site of involvement. Koral K et al<sup>9</sup> in their study have reported that the tumour is almost always solitary and multiple or bilateral pleomorphic adenomas are rare. All cases on MRI showing isointense signal on T1 and hyperintensity on T2 weighted images. A complete capsule was identified in one of the cases. Ikeda K et al<sup>(10)</sup> in their study suggested that no one MR finding distinguished pleomorphic adenomas from other parotid tumours and that the MR findings of a complete capsule, lobulated contour, or high T2 signal intensity have a predictive value of 74% for the diagnosis of pleomorphic adenoma.

2 cases of malignant salivary gland tumour was diagnosed in our study i.e. adenocarcinoma involving the parotid and high grade tumour of the submandibular gland. It was seen as a heterogeneously enhancing lesion with well-defined lobulated margins on CT and MRI. There was no involvement of the facial nerve or deep lobe. It was not possible to distinguish between the benign and malignant nature of the tumours on both MRI and CT. Kim KH et al<sup>11</sup> in their study concluded that both CT and MRI showed a similar level of accuracy in evaluation of salivary gland tumours, and showed a considerable tendency of misdiagnosis. Also that imaging features of a salivary gland mass can support a clinical diagnosis but cannot alone make a definitive histological diagnosis.

1 case was diagnosed to be infectious diseases involving the parotid gland. Alex L et al<sup>12</sup> described parotid tuberculosis as a rare lesion with nonspecific imaging findings 1 was a calculus induced sialadenitis of submandibular gland. The stone was removed and patient was given antibiotics. 1 case was diagnosed as a simple ranula and was seen on MRI as a well defined cystic lesion in the sublingual space with thin non enhancing walls. While simple ranula are confined to the sublingual space, plunging ranulas are centered on the submandibular space and tend to spill into one or more adjacent spaces.

### **Thyroid masses**

In our study there were 4 cases which were considered originating from the thyroid gland. Subsequently 1 case was diagnosed as multinodular colloid goiter with retrosternal extension and 3 cases were proven to be medullary carcinoma, follicular carcinoma and papillary carcinoma on FNAC. All patients were females in the age group 45-70 years except 19 year case of medullary carcinoma. As advocated by Laurie A Lovner et al<sup>13</sup>, the main role of cross-sectional imaging in thyroid neoplasms is not in the characterization of an intra thyroid lesion, as there are no imaging findings that are histologically specific. The role of the radiologist is to assess the findings related to a thyroid mass which will influence treatment decisions, including invasion through thyroid capsule and infiltration of adjacent tissues and structures of neck and to identify presence of cervical lymph node metastasis.

Accordingly, we assessed the following parameters in thyroid masses- size and location of the lesion, presence of calcification, haemorrhage, necrosis, thyroid capsule invasion, vascular invasion, involvement of trachea and oesophagus, mediastinal extension and adenopathy. All patients underwent total

thyroidectomy and histopathological examination of the post-operative specimen was done.

1 case of papillary carcinoma was misdiagnosed as multinodular goiter on USG and CT which was proven malignant on FNAC. Shetty SK in their study concluded that there is no CT feature that distinguishes benign from malignant lesions when correlated to sonographic appearance or histopathology. Sonography provides important additional information that may be useful in guiding further clinical management. <sup>14</sup>

### **Masses of developmental origin**

In our study 4 cases were diagnosed as masses of developmental origin which included lymphangioma (1 case), branchial cysts (2 cases) and thyroglossal cyst (1 case). 1 case was diagnosed to be lymphangioma. 1 was seen as a unilocular cystic lesion in the posterior triangle on CT in a 15 year old male patient. On USG it appeared as a mixed echogenicity mass with septae of variable thickness. lesion showed an average density of 25 HU (range 15-35 HU) on CT. Kraus J et al<sup>15</sup> have reported that these lesions are usually discovered in infants or children younger than two years of age and occurrence in adults is uncommon. In adults, solitary cystic hygromas can occur in the posterior triangle of the neck and in the submandibular triangle as was seen in our study. Naidu SI et al<sup>16</sup> have mentioned that cases presenting in adulthood often follow trauma or a preceding upper respiratory infection. However, no such history could be elicited in our cases.

2 cases of branchial cyst were diagnosed which was a second branchial cyst ( type II cyst ) in a 10 year male and 23 year old female patient which is the most common branchial anomaly (75%) described by Vazquez E et al.<sup>17</sup> It was seen as a cystic lesion posterior and lateral to the submandibular gland, anterior to the sternocleidomastoid muscle and lateral to the carotid space. The wall of the cyst showed enhancement and was thickened which was suggestive of infection. 1 case was diagnosed as a thyroglossal cyst in a 25 year old male patient. Ahuja et al<sup>18</sup> in their study have described thyroglossal cysts as midline or near-midline lesion, most commonly occur near the hyoid bone. On MRI, the cyst contents were T2 hyperintense. If the cyst occurs just caudal to the hyoid bone, it lies at the level of the thyrohyoid membrane of the larynx, stretching and bowing this membrane, so that on imaging the cyst appears to lie in the preepiglottic space of the larynx as was seen in our case During surgery however the cyst was seen to remain outside the larynx and was separated from the larynx without entering the larynx itself.

### **Masses of neurogenic origin**

Four cases of neurogenic tumor were observed in our study, three were vagal schwannoma and one was bilateral carotid paraganglioma. The vagal schwannomas appeared as a well-defined heterogeneously enhancing lesion in the post-styloid parapharyngeal space on both CT and MRI. Kehagias et al <sup>19</sup> have described that schwannomas appear as well-defined masses, usually of higher attenuation than muscle on contrast-enhanced CT images. MR evaluation

typically shows masses of intermediate signal on T1-weighted images and increased signal intensity on T2-weighted images, with smooth, well-delineated margins and a homogeneous overall appearance. Occasionally heterogeneity might be noted as in our patient.

According to Saito DM et al<sup>20</sup> anterior displacement of the common or internal carotid artery is a characteristic finding of parapharyngeal neurogenic tumours without splaying the internal and external carotid arteries. Vagal schwannomas separate the common or internal carotid artery from the jugular vein, whereas schwannomas of the cervical sympathetic chain do not. Similar pattern of vascular displacement was seen in our study. The neurogenic tumor was confirmed to be schwannoma arising from vagus nerve at surgery subsequently at histopathological examination.

### **Masses of vascular origin**

One case was diagnosed to have a hemangioma in parotid gland. Lesion was T2 hyperintense with heterogeneously enhancing on MRI. FNAC was done and aspirate contained blood. Patient was given sclerotherapy. One case was diagnosed of venolymphatic malformation in left parotid and surrounding region which was multicystic with subtle enhancement. Similar imaging findings have been described by Olsen et al. <sup>21</sup>

### **Inflammatory masses**

In our study two case of abscess in the retropharyngeal space was diagnosed in a patient presenting with painful swelling with fever, leucocytosis and neutrophilia. Abscess showed complete rim enhancement on CT and MRI. Few discrete level V lymph nodes were also noted. The abscess was drained and patient was given antibiotics. There was no evidence of abscess on follow up ultrasound. Freling N, Roele E et al<sup>22</sup> In their study concluded that as adequate clinical assessment is possible in such cases; imaging is only needed to delineate the extent of the infective process.

### **Masses of mesenchymal origin**

One case of lipoma in superficial lobe of right parotid, showing T1/T2 hyperintensity, without any contrast uptake on MRI was noted. FNAC was done which showed fat cells. The lipoma was excised. Monem M et al<sup>23</sup> described the posterior subcutaneous neck to be the most common site for lipomas in the head and neck. One case of hypopharyngeal synovial sarcoma which was well defined lesion T2 hyperintense and showing homogenous enhancement. El-MonemMHA et al<sup>24</sup> described similar rare case.

### **Conclusion**

Evaluation with CT and MRI allows radiologists to make a substantial contribution to the diagnosis and management of patients presenting with neck masses. Careful analysis of imaging features of a neck mass in combination with clinical history and physical examination produce a reasonably short differential

diagnosis in every case. CT and MRI ensure accurate anatomical localization and lesion characterization in benign lesions. In malignant tumors, these are useful for staging and provide essential information about the tumor extent that directly affects the surgical approach necessary for curative resection. CT and MRI are considered complementary modalities for imaging neck masses in adults. MRI has obvious advantages over CT in neck imaging like better soft tissue resolution, lack of ionizing radiation and safer contrast agents. By comparison CT examinations offer the advantages of superior assessment of osseous integrity, shorter examination time, wider patient access and lower cost.

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