IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 14, Issue 12 Ver. IX (Dec. 2015), PP 39-49
www.iosrjournals.org

CT Evaluation of Neck Masses

Ramen Talukdar[1], Rajkumar S Yalawar[2], Anil Kumar G V
[1]*Associate Professor, Department of Radiology, Gauhati Medical College and Hospital, Guwahati, India.*
[2]*Associate Professor, Department of Radiology, SSIMS & RC, Davangere, Karnataka, India.*

Abstract: *Neck swelling or neck mass is a very common presentation encountered in clinical practice. Because of its highly complex anatomy and physiology, neck disease manifesting as neck swelling can be varied from etiological, pathological and prognostic points of view. The radiological evaluation of neck masses has changed dramatically since the advent of multidetector computed tomography. Aims and Objectives: To assess the role of contrast enhanced CT neck in the evaluation of neck mass: location, morphological characteristics, extent, enhancement pattern and cervical nodal spread. Materials and Methods: A prospective study of 60 cases in a clinically suspected neck masses was studied for a 2 year period. Contrast enhanced CT of neck was done using Philips MX 16 CT Scanner with 3-5 mm axial sections. Wherever required Valsalva maneuver and 'E' phonation was carried out. Chi square test /Fischer exact test have been used to find the significance of CT scan findings with the final diagnosis. Conclusion: CT helps in precise anatomic localization, extent of the masses, allows differentiation of solid, cystic and mixed masses, tumor staging, pre and postsurgical assessment for better surgical management.*

Key words: *Carcinoma, Computed tomography, Infection, Metastatic cervical node, Neck mass*

I. Introduction

The neck is situated at the junction of head and the trunk and is crucial to the human body as organs responsible for vital functions like respiration, swallowing and circulation. Neck swelling or neck mass is a very common presentation encountered in clinical practice. Because of its highly complex anatomy and physiology, neck disease manifesting as neck swelling can be varied from etiological, pathological and prognostic points of view. The radiological evaluation of neck masses has changed dramatically since the advent of multidetector computed tomography. CT permits precise anatomic localization, extent of the masses and allows for differentiation of solid, cystic and mixed masses. The role of CT in differentiating benign and malignant lesions, tumor staging, pre and postsurgical assessment are of great value for better surgical management. Follow up cases after post radiation surveillance imaging improves palliation and prolongs disease free survival. Early treatment of local recurrence thus can result in good palliation, often lasting several years, which is of incalculable value to these patients and their families. Owing to the complex anatomy of the neck a comprehensive knowledge of regional anatomy and recognition of the patterns of disease presentation are vital to arriving at a meaningful differential diagnosis. Our study focus on CT evaluation of neck mass, characterize benign and malignant lesions, tumor staging and follow up.

II. Aims And Objectives

To assess the role of contrast enhanced CT neck in the evaluation of neck masses:

- Location, morphological characteristics and enhancement pattern
- Outline the extent and adjacent structures involvement
- Cervical nodal spread
- Surgical and histopathological correlation whenever possible

III. Materials & Methods

A prospective study of 60 patients who are clinically suspected of neck masses referred from ENT and few cases from Dr. B. Baruah Cancer Institute was studied in department of Radiology, Gauhati Medical College and Hospital, Guwahati from December 2011 to June 2013. Computed tomography (CT) of neck was done using Philips MX 16 CT Scanners with 3-5 mm axial sections and reformatted images to study in multiple planes. A 4-6 hours of fasting for contrast study and prior written consent was taken. Wherever required Valsalva maneuver and 'E' phonation was carried out. Chi square test /Fischer exact test have been used to find the significance of CT scan findings with the final diagnosis. Diagnostic statistics such as sensitivity, specificity, positive predictive value, negative predictive value and accuracy has been used to find the correlation of CT scan with final diagnosis.

Inclusion criteria: Palpable neck masses and USG detected neck lesions
Exclusion criteria: Trauma patients

IV. Images, Bargraphs, Tables, Charts

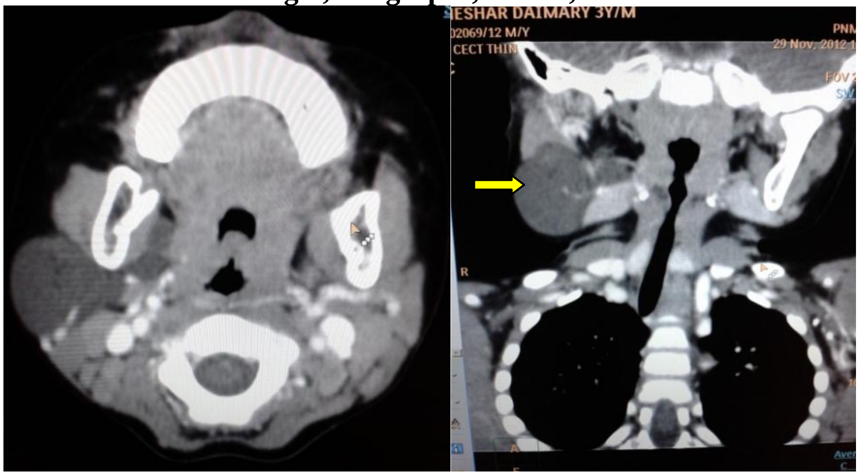


Figure 1: Cystic hygroma. Contrast enhanced CT of neck in a 3 year old body showing cystic lesion in the right side of neck.

Figure 2: Left parapharyngeal space infection. Contrast CT of neck in 45 year old female showing peripherally enhancing inflammatory collection in left deep neck spaces causing anterior displacement of neck vessels and compression of oropharynx.

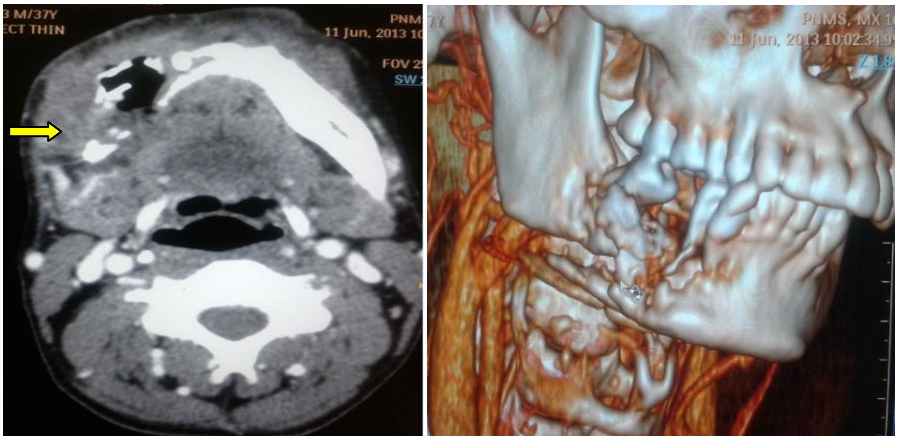


Figure 3: Buccal carcinoma with mandible involvement. Contrast CT of neck and 3 D SSD shows right lower buccogingival sulcal mass with erosion of body of mandible.

DOI: 10.9790/0853-141293949

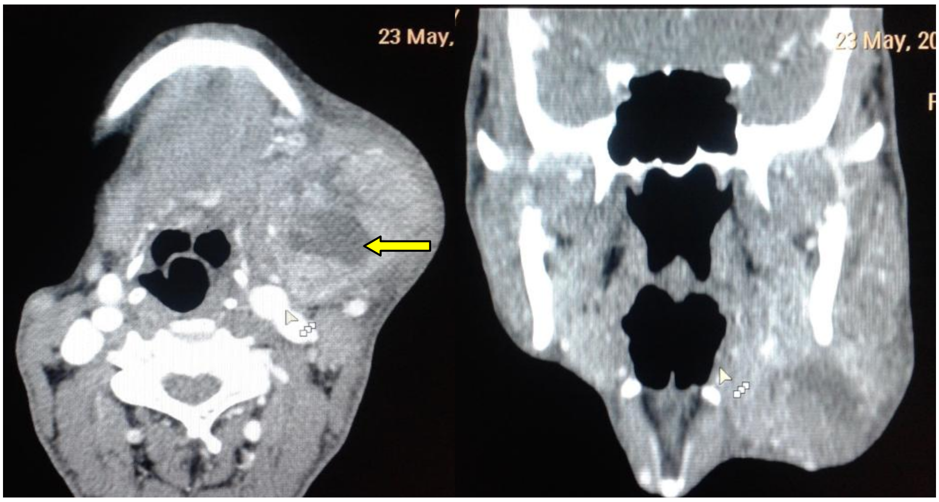


Figure 4: Submandibular gland carcinoma with necrotic node. Contrast CT of neck shows heterogeneously enhancing mass in left submandibular gland with necrotic cervical station IB node.

Figure 5: Right Aryepiglottic fold growth with pyriform sinus invasion

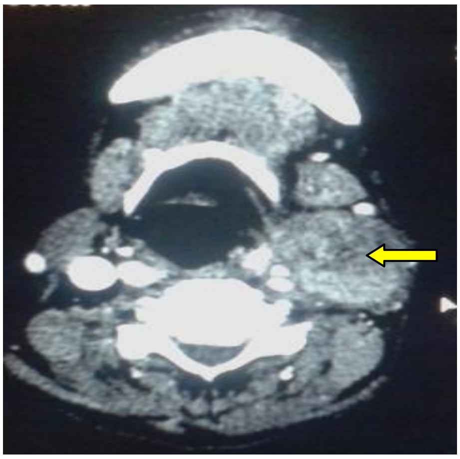


Figure 6: Metastatic necrotic left submandibular node station II, III

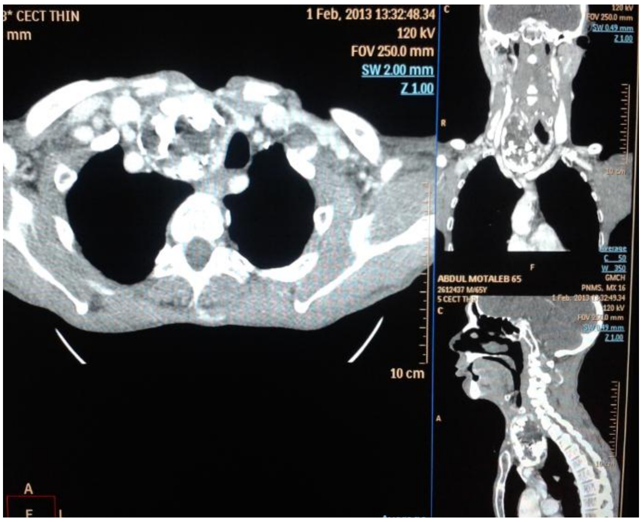


Figure 7: Multinodular goiter with retrosternal extension

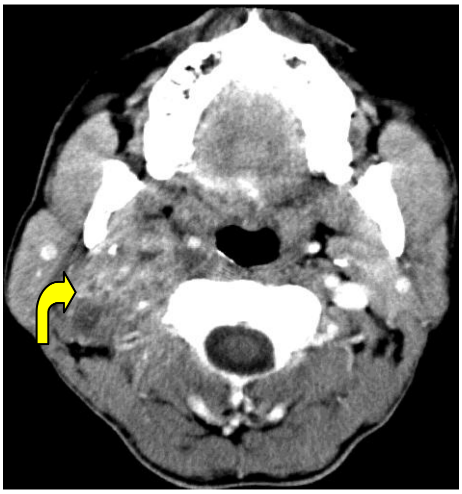


Figure 8: Vagal schwannoma. Contrast CT of neck shows heterogeneously enhancing mass in right submandibular region and posterior cervical space.

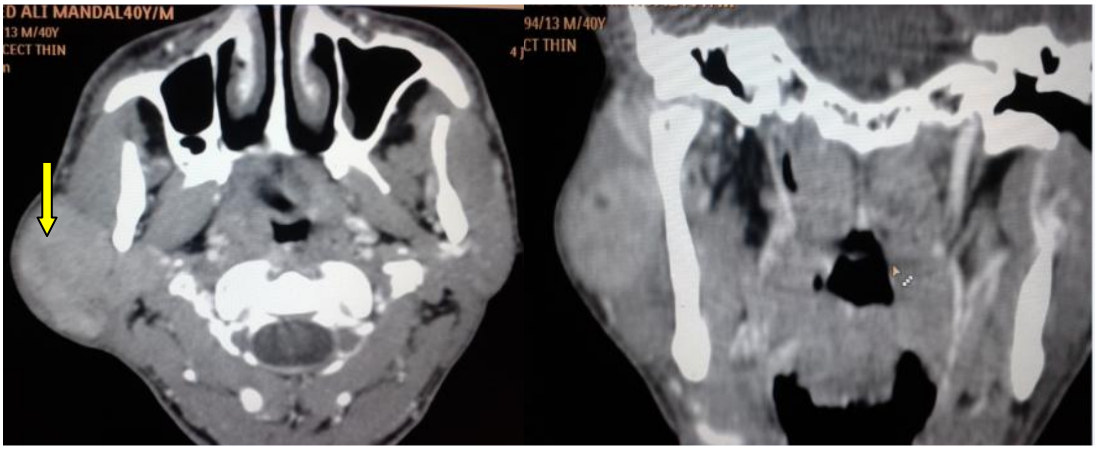


Figure 9: Malignant neoplasm of right parotid gland. Contrast CT of neck bulky right parotid showing heterogeneous enhancing mass.

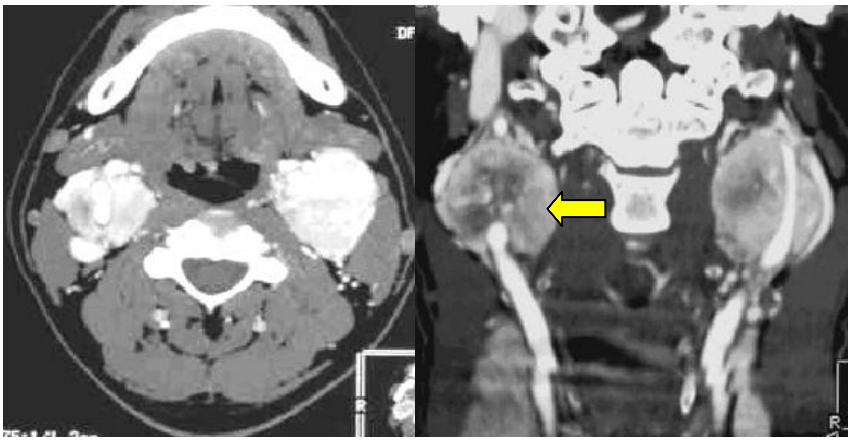


Figure 10. Bilateral carotid body tumor. Contrast enhanced CT of neck showing vividly enhancing mass splaying the carotid bifurcation

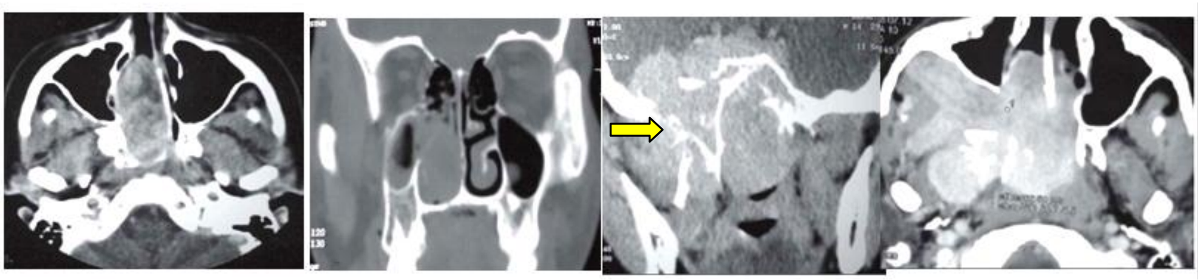


Figure 11: Juvenile nasopharyngeal angiofibroma.

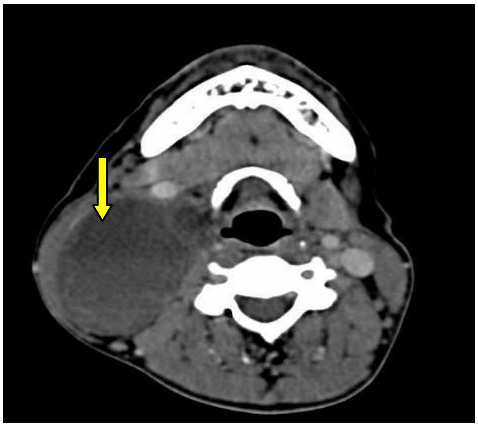


Figure 12: Infected branchial cyst.

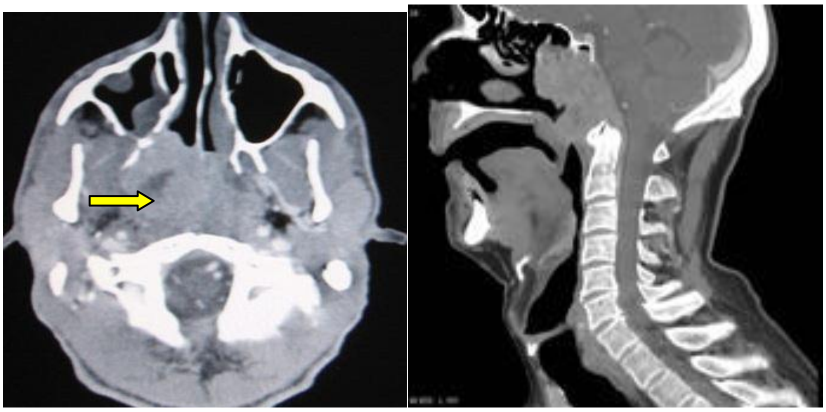


Figure 13: Nasopharyngeal carcinoma.

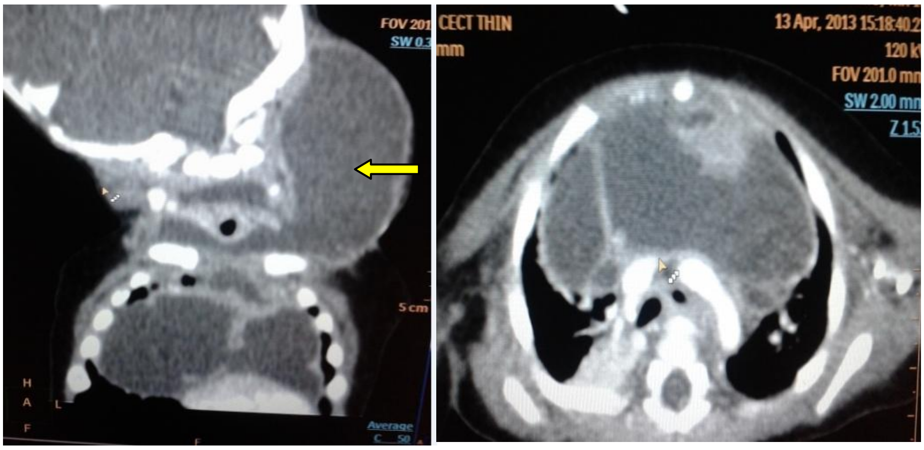
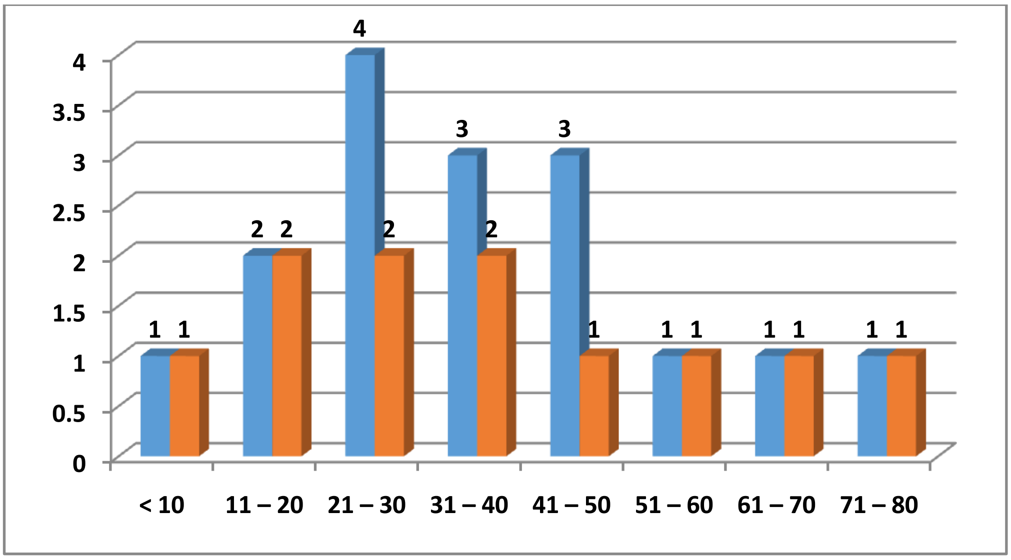
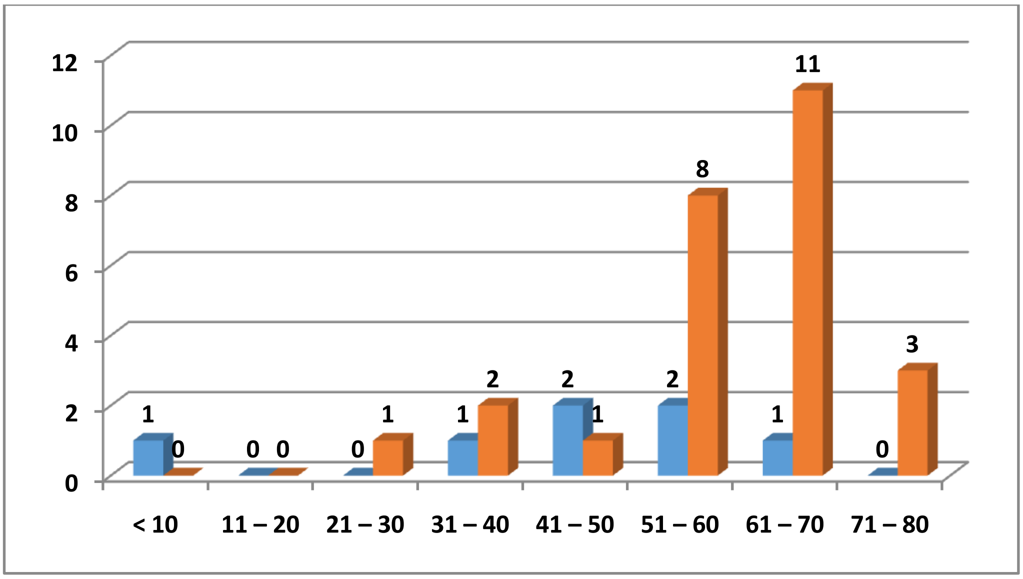


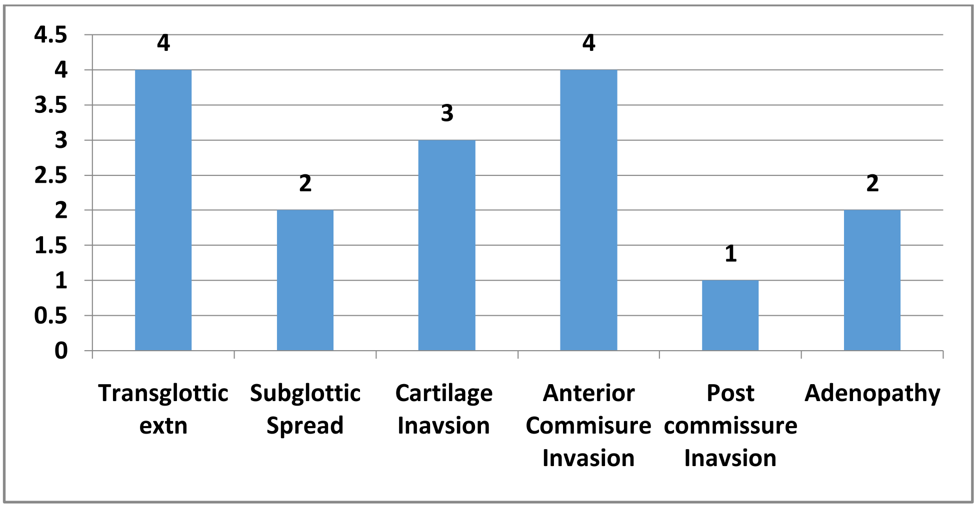
Figure 14: Retropharyngeal and pretracheal abscesses with mediastinal extension



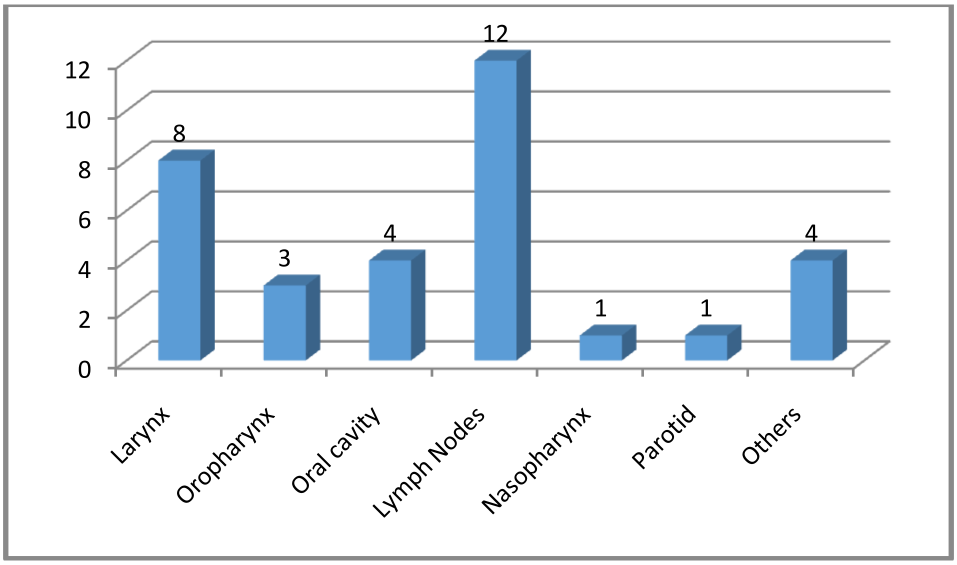
Bar graph 1: Age and gender distribution of the benign lesion (n=27)



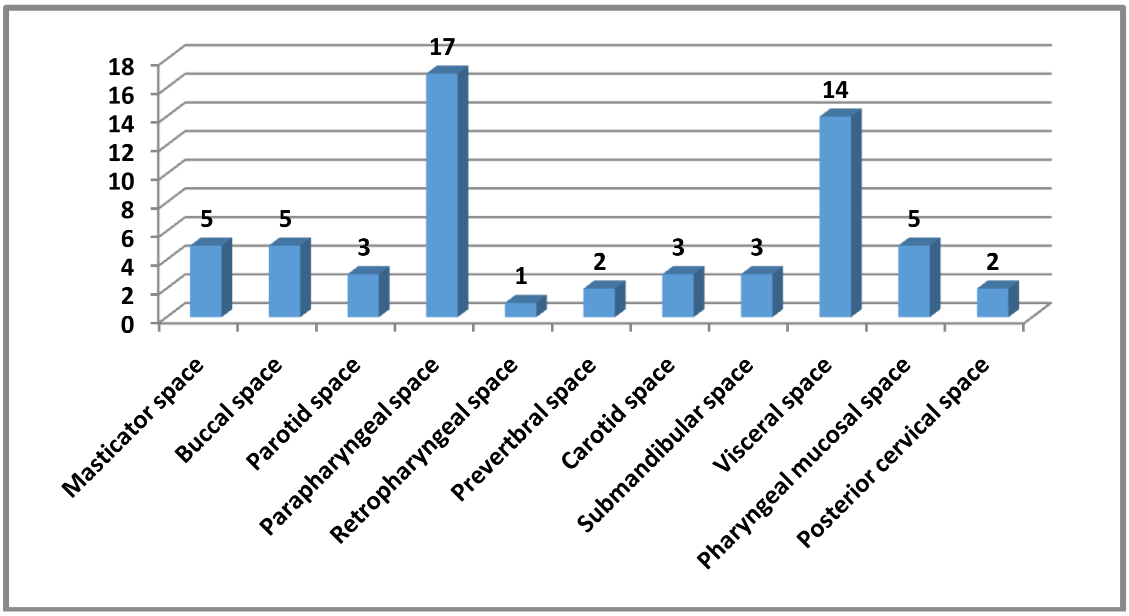
Bar graph 2: Age and gender distribution of malignant lesion (n=33)



Bar graph 3: Spread of supraglottic mass



Bar graph 4: Distribution of malignant lesion in hypopharynx



Bar graph 5: Distribution of neck mass in the neck spaces

Neck Lesions	BENIGN LESIONS									
	Enhancement		Necrosis		Bony invasion		Vascular invasion		Adjacent space invasion	
	Homogenous	Heterogenous	Negative	Positive	Absent	Present	Absent	Present	Absent	Present
Hemangiomas	2	0	2	0	2	0	2	0	2	3
Nasopharyngeal	0	1	1	0	0	1	1	0	1	0
Abscess		6	6	0	6	0	6	0	2	3
Lymphnodes	2	0	2	0	2	0	2	0	2	0
Lymphangioma		2	0	2	2	0	2	0	2	0
Branchial cleft cyst	2	0	2	0	2	0	2	0	2	0
Adenoids	1	0	1	0	1	0	1	0	1	0
Parathyroid adenoma	0	1	0	1	1	0	1	0	1	0
Vagal schwannoma		2	2	0	2	0	2	0	2	0
Post radiation necrosis	1	0	1	0	1	0	1	0	1	0
Mandibular AVM		1	1		1	0	1		1	0
Trigmeninal schwannoma		1	0	1	0	1	1	0	0	1
Multinodular goitre		3	1	2	3	0	3	0	3	0
Laryngoceles			2		2		2		2	
Total	10	17	21	6	25	2	27	0	20	7
	27		**27**		**27**		**27**		**27**	

Table 1: CT Characteristics of Neck Mass (N= 60), Benign Lesions (N= 27)

MALIGNANT LESIONS	**MALIGNANT LESIONS**									
	Enhancement		**Necrosis**		**Bony invasion**		**Vascular invasion**		**Adjacent space invasion**	
	Homogenous	**Heterogeneous**	**Negative**	**Positive**	**Absent**	**Present**	**Absent**	**Present**	**Absent**	**Present**
Laryngeal carcinoma	**1**	**7**	**2**	**6**	**5**	**3**	**8**	**0**	**3**	**5**
Buccal carcinoma	**1**	**3**	**2**	**2**	**3**	**1**	**4**	**0**	**4**	**0**
Nasopharyngeal carcinoma		**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**1**
Submandibular neoplasm		**1**	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**
Oropharyngeal carcinoma		**2**	**0**	**2**	**1**	**0**	**0**	**2**	**0**	**2**
Maxillary carcinoma		**1**	**0**	**1**	**1**	**1**	**1**	**0**	**0**	**1**
Lymphoma	**3**		**3**	**0**	**3**	**0**	**2**	**0**	**3**	**0**
Paraganglioma	**1**		**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**
Metastatic carcinoma		**11**	**0**	**11**	**11**	**0**	**11**	**0**	**11**	**0**
Papillary carcinoma		**1**	**0**	**1**	**1**				**1**	**0**
Adenoid cystic carcinoma		**1**		**1**	**0**	**1**	**1**	**0**	**0**	**1**
Subtotal	**6**	**27**	**9**	**24**	**26**	**7**	**31**	**2**	**23**	**10**
Total	**33**		**33**		**33**		**33**		**33**	

Table 2: CT Characteristics of Neck Mass of Malignant Lesions (n= 33)

Lesions according to space	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
Submandibular space	100	100	100	100	100	<0.001**
Masticator space	100	97.8	80	100	98	<0.001**
Buccal space	80	100	100	98	98	<0.001**
Parapharyngeal space	100	100	100	100	100	<0.001**
Carotid space	100	100	100	100	100	<0.001**
Parotid space	100	100	100	100	100	<0.001**
Pharyngeal mucosal space	100	100	100	100	100	<0.001**
Retropharyngeal space	100	100	100	100	100	<0.001**
Prevertebral space	100	100	100	100	100	<0.001**
Visceral space	100	100	100	100	100	<0.001**

Table 3: CT neck lesions- Imaging accuracy in different neck spaces

CHART 1: CLASSIFICATION OF NECK MASSES

I. Nodal mass

Benign -

- Tubercular
- Atypical tubercular
- Syphilis
- Brucella
- Fungal granuloma
- Drug reaction

Malignant

- Primary-Hodgkin’s lymphoma
- Lymphosarcoma

Secondaries- with primary in neck, thorax or abdomen

II. Non-nodal mass

Masses of Aerodigestive Tract

- Laryngeal Malignancy
- Hypopharyngeal Malignancies
- Cervical Oesophageal Malignancies

Masses of Developmental Origin

- Branchial Cyst
- Cystic Hygroma/Cavernous Lymphangioma
- Thyroglossal Duct Cyst
- Dermoid Cyst

Masses of Inflammatory Origin

- Cellulitis
- Abscesses

Masses of Neural Origin

- Schwannomas & Neurofibromas

Masses of Vascular Origin

- Internal Jugular Vein Thrombosis
- Paragangliomas or Glomus Tumours

Masses of Thyroid and Parathyroid Gland

Masses of Major Salivary Glands

V. Discussion

The most common congenital lesions of the neck are thyroglossal duct cysts, branchial cleft anomalies and cystic hygroma. Other congenital masses include hemangioma, teratoma and dermoid. Thyroglossal duct cyst are the most common non-odontogenic cysts that occur in the neck[1, 2]. They account for approx 70% of the congenital neck swelling. It the migration of the thyroglossal duct fails to involute anywhere along its course, a cyst may from because the duct is lined with secretory epithelium. Occasionally remnants of thyroid tissue are found coexisting within these cysts[2]. The pathogenesis of branchial cleft anomalies is controversial. Incomplete obliteration of the bronchial apparatus, primarily the cleft postulated for their development [3]. The closing membrane and pouch are involving in the development of sinuses and fistula. Most branchial cleft anomalies arises from second branchial apparatus. Most lesions present clinically between 10 and 40 years of age, but may present at any age. There is an equal incidence of branchial fistulae, sinuses and cysts in males and females. Branchial sinuses may be familial in origin. The usual presentation is of a smooth non-tender fluctuant mass adjacent to the anteromedial border of the sternocleidomastoid muscle at the angle of the mandible[3]. Cystic hygroma develop from portions of primitive lymph sacs which have been sequestered from primary lymph sacs during embryonic life [4]. Cystic hygroma are often detected at birth and most lesions appear before two years of age. It contain lymphatic cysts ranging in size from a few millimeters to several centimeters in diameter. Cystic hygroma and lymphangioma are considered part of the spectrum[5,6].

Most laryngeal imaging is performed in order to evaluate tumours or trauma. Imaging provides detailed information about the extent and depth of tumours, information that often cannot be ascertained by means of physical examination alone. Cancers of larynx represents about 1% of all cancers diagnosed in the western countries, but the incidence is much higher in India. Most laryngeal carcinomas are squamous cell carcinomas[7]. The most common risk factors for laryngeal carcinomas are considered to be smoking and alcohol. More than 95% of patients with laryngeal cancer have been found to be smokers. About 2% of patients with laryngeal papillomas, associated with human Papilloma virus (HPV) will develop laryngeal carcinoma [7]. Because the larynx is accessible to direct visualization, the diagnosis is usually known prior to imaging. The endoscopist is limited in the ability to define the deep extent of a lesion relation to precise landmark used to determine whether the patient is a candidate for a speech conservation surgery or radiotherapy. Computed tomography of neck represents a major advance in laryngology. The ability of CT to show mucosal and deep laryngeal tissue and associated deep lymphatic chain involvement makes it an ideal radiological investigation for evaluation of laryngeal tumours. The presence of involved neck nodes is the most important prognostic indicator in patient with head and neck cancer and clinical palpation is known to be inaccurate technique for the assessment of neck. Contrast enhanced CT and MRI will upstage approximately 20% of patients who are thought to have clinically negative nodes. Nodes may not be palpable of a deep location such as retropharyngeal or high deep cervical chain. The neck becomes more difficult to palpate following previous surgery of radiotherapy. Nodal staging is concerned with the presence or absence of nodal disease, nodal size, and assessment of the involved nodes [8]. The AJCC and the International Union against Cancer (UICC) developed in 1987 a common staging system intended to overcome the pitfalls of the subjective palpation of the nodes [9]. The latest refinement of this staging refers to all head and neck cancers except nasopharyngeal carcinoma and thyroid carcinoma, which need separate nodal staging.

Carcinomas of the oral cavity tend to spread to nodes in the level IA, IB, II and III while carcinomas of oropharynx, hypopharynx and supraglottic larynx tended to metastasize to nodes in levels II, III and IV[10]. The clinically silent but imaging identified retropharyngeal nodes tend to harbor metastasis from primaries in the hypopharynx, lateral and posterior oropharynx, tonsillar fossa and soft palate. The visceral nodes (levels VI and VII) tend to be involved in primary carcinomas of the supraglottic larynx, cervical esophagus, cervical trachea and thyroid[11, 12,13]. The main role of cross-sectional imaging (Ultrasound, CT and MRI) is not in the characterization of intrathyroid lesion, as there are no imaging finding that are histologically specific. The role of the radiologist is to assess the findings related to a thyroid mass, including invasion through the thyroid capsule, infiltration of adjacent tissues and structure of neck and identify presence of cervical lymph node metastasis. Thyroid carcinomas arise from both follicular and parafollicular C cells. The major histological classification of thyroid carcinomas include papillary, follicular, medullary and low grade (papillary carcinoma)[14] to aggressive (anaplastic type) and reflected by the mortality rates papillary carcinomas 8 to 11% follicular carcinomas 24 to 33% medullary carcinomas 50% and anaplastic carcinoma 75 to 90%.

Schwannomas and neurofibromas are the most common types of neurogenic tumors found in the head and neck [15]. Common sites for schwannomas and neurofibromas in the neck are the vagus nerve, less commonly the glossopharyngeal nerve, the ventral and dorsal cervical nerve roots, the cervical sympathetic chain, and the brachial plexus.

When they are large, associated motor dysfunction and pain in the distribution of a sensory nerve are varying clinical findings because, for example, salivary gland tumors tend to invade nerves. Because the cervical sympathetic chain runs in a relatively loose fascial compartment, compression, such as is seen in other schwannomas, are exceedingly rare.

Salivary gland tumors in the prestyloid PPS commonly arise from the deep lobe of the parotid gland and extend into the PPS through the stylomandibular tunnel. However, salivary gland tumors can also arise primarily within the prestyloid compartment from congenital rests of salivary gland tissue. The CT appearance of a benign salivary gland tumor is usually that of an ovoid soft tissue mass[17]. When small, the tumor is typically homogeneous; when larger, it may show variable areas of low attenuation that represent sites of cystic degeneration or seromucinous collections. Focal areas of high attenuation representing calcification may also be present[16].

In our study, 60 cases studied 27 (45%) were benign and 33 (55%) were malignant neck lesions. Overall there was a male preponderance with 35 (60%) males and 25 (40%) females, male to female ratio of 3:2. Among the neck lesions the most common was metastatic lymph-node mass (24%) followed by laryngeal carcinoma(13.3%) and oral cavity malignancy. Most of the infection (66.66%) of neck were below the age group of 40 years. Benign lesion were common in the age group of 21-30 with a female to male ratio of 1.4:1. Malignant lesions were more common in the elderly age group of 61-70 years with a male to female ratio of 3:1. The most common space involvement was parapharyngeal space (28.3%) followed by visceral space (23%). Most of the malignant lesions showed heterogeneous contrast enhancement (73%), necrosis (70.6%), bone involvement (20%), vascular involvement IJV thrombosis (7%) and extension into adjacent spaces 27 %. CT has 96 % accuracy in diagnosing neck lesions. CT has 100 % accuracy in predicting bony involvement in head and neck cancers. Advantages of MDCT includes ability to perform thin slices, short scan time, reconstruction and ability to perform MIP,SSD, MPR and curved reformatted images.

VI. Conclusion

CT has an excellent accuracy in studying location, characterizing and enhancement patterns in the neck lesions. CT was extremely beneficial in preoperative evaluation of tumour spread to bone and surrounding tissues and staging. MDCT has the capability to delineate the bone erosion or destruction with highest accuracy among all imaging modalities.

Conflict of interest: Nil
Fund support: Nil

References

[1] Ahuja AT, Wong KT, King AD, Yuen EH: Imaging for thyroglossal duct cyst: The bare essentials. Clin Radiol 2005; 60:141-148.
[2] Brousseau VJ, Solares CA, Xu M, et al: Thyroglossal duct cysts: Presentation and management in children versus adults. Int J Pediatr Otorhinolaryngol 2003; 67:1285-1290.
[3] Shin JH, Lee HK, Kim SY, et al: Parapharyngeal second branchial cyst manifesting as cranial nerve palsies: MR findings. AJNR Am J Neuroradiol 2001; 22:510-512.
[4] Zadvinskis DP, Benson MT, Kerr HH, et al: Congenital malformations of the cervicothoracic lymphatic system: Embryology and pathogenesis. Radiographics 1992; 12:1175-1189.
[5] Lev S, Lev MH. Imaging of Cystic Lesions. Rad Clin N Am; Sept 2000; 38:1013-1029.
[6] Som P: Cystic lesions of the neck. Postgrad Radiol 1987; 7:211-236.
[7] Som PM, Curtin HD. The Larynx. Head and neck imaging, vol 2. 4th ed. St. Louis: Mosby; 2003:1595-1699.
[8] Gor DM, Langer JE, Loevner LA: Imaging of cervical lymph nodes in head and neck cancer: The basics. Radiol Clin North Am 2006; 44:101-110.
[9] King AD, Tse GM, Ahuja AT, et al: Necrosis in metastatic neck nodes: Diagnostic accuracy of CT, MR imaging, and US. Radiology 2004; 230:720-726.
[10] Layland MK, Sessions DG, Lenox J: The influence of lymph node metastasis in the treatment of squamous cell carcinoma of the oral cavity, oropharynx, larynx, and hypopharynx: N0 versus N+. Laryngoscope 2005; 115:629-639.
[11] Okura M, Kagamiuchi H, Tominaga G, et al: Morphological changes of regional lymph node in squamous cell carcinoma of the oral cavity. J Oral Pathol Med 2005; 34:214-219.
[12] Sarvanan K, Bapuraj JR, Sharma SC, et al: Computed tomography and ultrasonographic evaluation of metastatic cervical lymph nodes with surgicoclinicopathologic correlation. J Laryngol Otol 2002; 116:194-199.
[13] Van den Brekel MW, Castelijns JA: What the clinician wants to know: Surgical perspective and ultrasound for lymph node imaging of the neck. Cancer Imaging 2005; 5(Spec No A):S41-49.
[14] Majima T, Doi K, Komatsu Y, et al. Papillary thyroid carcinoma without metastases manifesting as an autonomously functioning thyroid nodule. Endocr J 2005;52(3):309–316.
[15] Wax MK, Shiley SG, Robinson JL, Weissman JL: Cervical sympathetic chain schwannoma. Laryngoscope 2004; 114:2210-2213.
[16] Spiro RH, Huvos AG, Berk & suong EW. Mucoepidermoid carcinoma of salivary gland origin. The American Journat of Surgery 1978; 136:461-8.
[17] Lu YC, Fan WJetal: CT features of parotid tumors: an analysis of 133 cases.2007 Nov;26(11):1263-7.