Role of Multidetector CT in the Evaluation of Neck Lesions

Zafar Ali[1], Raunak Sinha[2], Manish Jaiswal[3]

[1]Postgraduate Trainee, Department of Radiodiagnosis, Katihar Medical College, Katihar, Bihar, India.
[2]Postgraduate Trainee, Department of Radiodiagnosis, Katihar Medical College, Katihar, Bihar, India.
[3]Assistant Professor, Department of Radiodiagnosis, Katihar Medical College, Katihar, Bihar, India.

ABSTRACT

BACKGROUND
This study is an effort to assess the role of multidetector CT in evaluation of neck lesions.

METHODS
50 patients with neck lesions were subjected to MDCT and images were analysed on plain scan and contrast enhanced scans done after I.V. administration of non-ionic contrast. Lesions were studied on the basis of pattern of enhancement, vascular and bony involvement, and local invasion. Usefulness of CT examination regarding prediction of the benign and malignant nature of the lesions was analysed.

RESULTS
27 malignant and 23 benign lesions were identified in our study. Accuracy of MDCT for predicting the benign and malignant nature of lesions was 97%. Final diagnosis of benign and malignant lesion was confirmed by histopathology examination. MDCT examination predicted the local invasion and vascular involvement of the lesion.

CONCLUSIONS
MDCT is very useful tool for localizing and characterizing neck lesions. Because of easy availability of vascular contrast enhancement, increased detection of the lesion, and multi-planar reformatting technology of MDCT, it can be considered as one of the good modalities for evaluation of neck lesions.

KEYWORDS
Computed Tomography, Neck Masses, Spiral, Multislice

Corresponding Author:
Dr. Zafar Ali,
Postgraduate Trainee,
Department of Radiodiagnosis,
Room No. 202, PG Boys Hostel,
Katihar Medical College,
Karimbagh, Katihar-854106,
Bihar, India.
E-mail: zafarali.ali684@gmail.com

DOI: 10.18410/jebmh/2020/405

How to Cite This Article:
Ali Z, Sinha R, Jaiswal M. Role of multidetector CT in the evaluation of neck lesions. J. Evid. Based Med. Healthc. 2020; 7(36), 1947-1950. DOI: 10.18410/jebmh/2020/405

Submission 19-06-2020,
Peer Review 23-06-2020,
Acceptance 22-07-2020,
Published 07-09-2020.

BACKGROUND

Neck is a conical space that is situated between base of skull up to the thoracic inlet. A mass lesion in the neck can be diagnostic challenge in any patient irrespective of age group. Neck masses includes a spectrum of lesions of diverse origin.[1] Computed tomography plays important role in evaluation of any mass lesion of neck. The main reason for neck imaging is to evaluate the extent of disease to determine surgical and therapeutic options. It includes evaluation of size of masses, its location and extent of tumour infiltration into surrounding vascular and visceral structures. In 1992 multi slice computed tomography was introduced with the advent of dual-section-capable scanners and was improved in 1998 following the development of quad-section technology.[2] The ease of obtaining CT scans and rapid scan acquisition are its advantages. Multi-slice CT (MSCT) has rapidly become the new standard in radiological imaging. Although its advantages in cardiovascular, thoracic and abdominal imaging are evident, the extent of its usefulness for imaging the head and neck has yet to be clarified.[3] Improved resolution and considerable reductions in scan acquisition, display, and improved temporal resolution into venous, arterial phase have increased utilization of multislice tomography. Two and three-dimensional displays are used to visualize pathological findings in topographic relation to anatomical structures. The radiologist can point out to the clinician the pathological findings by some essential images. Thus, multislice helical technology has the usefulness of CT in evaluation of neck masses. Many studies have done in past and evaluated and established the status of computed tomography as one of the modality of choice in the evaluation of neck lesions. Present study aim is to evaluate the role of multislice spiral CT in the evaluation of neck lesions.

METHODS

This study was performed among 50 patients who underwent MDCT scan for diagnosis of head and neck lesions, all patients were referred by the clinical departments of Katihar Medical College and Hospital, Katihar, India. Non-contrast and contrast enhanced CT examination of all patients was performed using GE ACTs CT scanner. All CT scanning protocols were used according to the age, weight and clinical condition of the patients. Multi-planar reconstruction was performed with/without volume rendering in all cases and useful information was collected. Imaging findings of all patients were correlated with the clinical course of disease and surgical/ pathological findings. The usefulness of CT examination regarding the prediction of the nature of mass (cystic/solid/mixed density and benign/malignant), location of lesion, (exact organ of origin), local extant of lesion and its correlation with the final clinical/ histopathological/ surgical diagnosis was studied.

The accuracy of the study was calculated as the percentage of cases with respect to CT scan findings correctly matched with clinical / surgical / histopathological findings. The study was approved by the ethics committee of the institution where study was carried out.

Statistical Analysis

Data tabulation was done to study the malignant and benign characteristics which helped in deciding the benign/malignant nature and diagnosis of each neck lesions.

Features	Benign (Total=23)		Malignant (Total=27)	
	Number	(%)	Number	(%)
Homogenous enhancement	9	39.2	4	14.8
Heterogenous enhancement	14	60.8	23	85.1
Bony invasion	1	4.3	6	22.2
Vascular invasion	0	0	2	7.4
Lymphadenopathy	2	8.6	12	44.4
Necrosis	5	21.5	21	77.7
Local invasion	6	25.8	8	29.6

Table 1. Tabulation of Lesions According to Characteristics of Lesions

RESULTS

This study includes 50 cases of neck lesions of various age groups. The age range in this study is 3 years to 80 years. Certain imaging parameters, like enhancement of lesion (homogenous/heterogenous) absence or presence of vascular/bony invasion were used to define each lesion in the study. On the basis of these characteristics the lesions were classified as malignant or benign. Benign lesions shows homogenous enhancement without any significant necrosis and involvement of adjacent structures be it bony or vascular. However, malignant lesions show heterogenous enhancement with necrosis and bony invasion and extension into adjacent structures/ spaces in almost in all malignant lesions.

Figure 1. Axial, Sagittal and Coronal CT Images Showing Lymphoma of Waldeyer's Ring with Involvement of Nasopharyngeal and Faucal Tonsils. Cervical Lymphadenopathy with Necrosis and Marked Narrowing of the Pharyngeal Airway

Malignant nature of the lymph nodes can be accurately predicted on multislice CT in all patients with radiological findings of rounded contour, absence of hilum, eccentric cortical thickening, ill-defined margins with loss of intervening fat plane to adjacent structures. Below table describes the importance of the various features to define the malignant/benign nature of the neck masses shown in table 1. The larger group of patients in this study is 0-20 years (36%) and second largest group is 51 years to 70 years (32%). The accuracy of the MDCT for predicting the benign and malignant nature of the lesions was 97%. The final diagnosis of benign and malignant lesion was confirmed by histopathology examination.

Age Group (Years)	Number of Patients	Percentage (%)
3 - 10	9	18
11 - 20	10	20
21 - 30	2	4.0
31 - 40	6	12
41 - 50	5	10
51 - 60	7	14
61 - 70	8	18
71 - 80	2	4.0
Total	**50**	**100**

Table 2. Age Distribution

DISCUSSION

Computed tomography has been found to be increasing applications the evaluation of patients with neck mass lesions. However it is non-invasive, non-operator dependent and allows the measurement of tissue attenuation coefficient. Spiral CT improved the examination quality, reducing the sedation time and requiring lower radiation dose.[4] Use of multiple detector allows faster scanning and thinner collimation.[5] With multislice CT a high-quality volume data can be obtained, and multi-planar reconstruction can be obtained. Usually additional coronal scanning is not necessary with multislice spiral CT.[6]

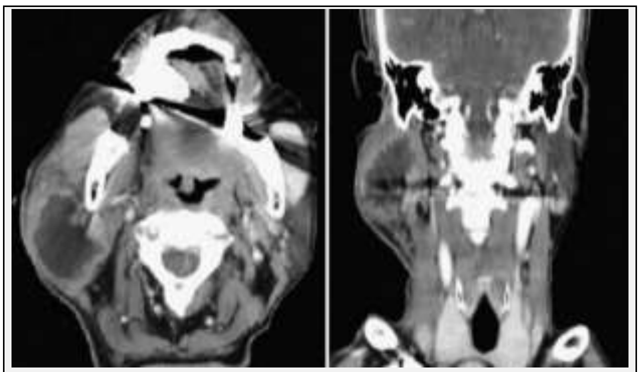

Figure 2. Warthin's Tumour of the Right Submandibular Gland. Axial and Coronal CT Image Showing a Well Defined Lesion with Heterogeneously Enhancing Solid Areas and Hypodense Cystic Areas with Peripheral Rim Enhancement. Splaying of Right Submandibular Gland around the Lesion (Claw Sign) with Absence of Intervening Fat Plane Suggests an Exophytic Mass Lesion Arising from the Right Submandibular Gland

The radiologist may tell to the clinician the pathological findings by some essential images without having to demonstrate all axial slice.[7] Histopathological diagnosis may be suggested on CT scan by its location and characteristics CT findings. Advantages of helical CT can improve even greater effects in children more than adults. Reduction in data acquisition time is particularly useful in children and in the other un-cooperative patients. Due to faster speed of scanning, motion related problems have decreased. In addition, sedation can be avoided in majority of paediatric patients.[8] In high resolution mode the anatomical details are more superior which are obtained by MRI imaging. Thin sections can be obtained without disturbing the resolution which is superior to the MRI. However patient compliance is high. The use of a bolus injector now provides excellent CT contrast delineation, much greater than that was available in previous decades. Although the cost is more than sonography, but CT is often the only examination much needed and less expensive than MR imaging. It remains one of the the best modality for imaging a bony matrix and excellent for detecting small soft-tissue calcifications. No doubt CT has its own disadvantages. Be it the use of ionizing radiation, which are undesirable in children and pregnant women, it need an iodine-based contrast agent injection, which can lead to risk of allergic reactions, and in certain areas of the neck CT does not provide soft tissue definition equivalent to that attainable with MR imaging[9]. Total of 50 cases of neck masses were evaluated in this study with age group from 3 years to 80 years. In cases with malignant and benign conditions the extend of pathology, local and contiguous spread, and vascular involvement in cases of malignant masses, evaluated using multislice CT examination. Out of 50 cases studied 23 (46%) were benign and 27 (54%) were malignant. Most of the malignant lesions of the head and neck region including oral carcinomas and pharyngeal mucosal space carcinoma and visceral space carcinoma and metastatic lymph nodes were found in patients above the age of 40 years.

The most common lesion in this study was lymph node cases were 12 (24%) and out of which malignant 10 (83%) and 2 were benign. The most common malignant lesion in the neck in this study was found to be metastatic lymph nodes (37.7%) and. Salivary gland tumours constituted the second largest group of patients i.e. eleven (22%) patients. Only two (18%) tumours were benign both involving submandibular glands. There were nine (81%) malignant tumours; eight were invasive with ill-defined margins and/or invasion of adjacent fat and were correctly diagnosed as malignant on computed tomography only one patient, who presented with two well-defined nodules in right parotid gland was incorrectly diagnosed as benign on computed tomography, but on histopathological examination proved to be malignant. Bryan et al[10] reported that by computed tomography, all the benign lesions were correctly identified as benign, however 7% of the malignant lesions were incorrectly considered to be benign[10]. Mucoepidermoid carcinoma was the second most common malignant tumour, constituting 4/11 (8%) cases. All four cases i.e. 100% were involving the parotid gland. Spiro et al[11] retrospectively reviewed 367 patients of mucoepidermoid carcinoma of the salivary gland origin and then observed that 69% of all mucoepidermoid carcinomas arose from parotid gland.

The benign lesions were nasopharyngeal angiofibroma and right sternocleidomastoid vascular malformation and trigeminal schwannoma and benign lesions caused bony expansion and remodelling rather than bony destruction and erosion however malignant lesion counted buccal carcinoma, adenoid cystic carcinoma, maxillary carcinoma, nasopharyngeal carcinoma, thyroid carcinoma and laryngeal carcinoma with evidence of bony erosions in malignant cases. In present study 1 case of nasopharyngeal angiofibroma was diagnosed with involvement of pterygopalatine fissure and nasopharynx and invading the maxillary and ethmoid sinuses with intracranial extension with intense vascular enhancement on contrast administration. This study is comparable with the study done by the K.V. Narayanaswamy et al, in which 8 cases of juvenile nasopharyngeal angiofibroma were studied and all lesions shows intense enhancement and intracranial extension. In one patient was found to have vascular malformation involving right sternocleidomastoid on CT scan. CT angiography were provided for an excellent delineation of the entire extent of the lesion with clear demonstration of feeding artery and draining vein. In the present study 5 cases of laryngeal carcinoma were encountered and all five cases were accurately diagnosed with 100% sensitivity and specificity. In the present study 3 cases of thyroid carcinoma were encountered and was diagnosed with bone/cartilaginous involvement. In patients with malignant cervical mass lesions CT examination revealed the extent of the lesions with invasion to the adjacent structures, vascular encasement and thrombosis. In the patient with anaplastic carcinoma of thyroid, CT clearly demonstrated the invasion of trachea, oesophagus and prevertebral muscles with a clear demonstration of the encasement of right carotid and jugular vessels on multiplanar reconstruction including inoperability. CT appearances were diagnostic in patients with cervical lipoma, mesenteric cysticercosis, cervical lymphangioma, and thyroglossal duct cyst.

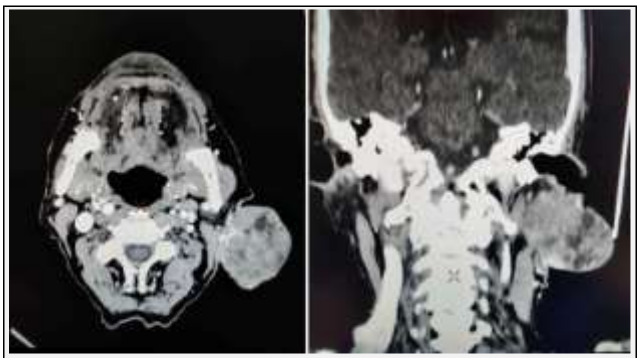

Figure 3. Pleomorphic Adenoma Protruding Out from the Left Parotid Gland. Axial and Coronal CT images Showing Foci of Necrosis with Moderate Homogenous Enhancement and Loss of Intervening Fat Plane Arising from the Left Parotid Gland

The reduction in imaging time possible in multislice CT scanners has facilitated optimal contrast enhancement during CT of neck, chest, abdomen and pelvis, in certain patients like those having lymphoma, using a single I.V. contrast material bolus. This fact was re-emphasized time and again in various cases in our study, especially in cases with vascular lesions. A very important aspect about the Multislice CT examination in paediatric patients, as found in our study, was the negligible frequency and severity of the motion artifacts in the studied cases. In none of the cases studied by us were motion artifacts encountered to the extent so as to seriously hamper the diagnostic quality of the images. No major information loss was noted in any case due to these artifacts. Sedation was required in only one patient. Thus, the multislice CT scanners, in addition to strengthening the proven efficacy and augmenting the high diagnostic accuracy, has provided solution to many questions unanswered by conventional imaging modalities, like longer acquisition time, degradation of informative data due to motion artifacts and utility as single modality in assessment and staging of tumours and pathologic conditions. With the advantages of improved vascular contrast enhancement, increased detection of lesion, and multiplanar three dimensional reconstructions, multislice spiral CT should be one of the modalities of choice in the evaluation of neck masses.

CONCLUSIONS

Multi-detector computed tomography of neck has improved the localization and characterization of neck lesions. The most important advantage of MDCT is its ability to detect bony lesions (erosions and expansion). Since CT is fast, well tolerated, readily available, and low cost, it can be used for initial evaluation, biopsy, preoperative planning, postoperative follow-up, plan for radiotherapy ports, and reserve MRI. It can also be used as a compulsory imaging modality for those tumours which are having higher chance of perineural spread. However, histopathology still remains the gold standard as CT is not 100% accurate.

Financial or Other Competing Interests: None.

REFERENCES

[1] Mancuso AA, Dillon WP. The neck. Radiologic Clinics of North America 1989;27(2):407-33.
[2] Rydberg J, Buckwalter KA, Caldemeyer KS, et al. Multisection CT: scanning techniques and clinical applications. Radiographics 2000;20(6):1787-1806.
[3] Imhof H, Czerny C, Dirisamer A. Head and neck imaging with MDCT. Eur J Radiol 2003;(45 Suppl 1):23S-31S.
[4] Kalender WA. Principles and applications of spiral CT. Nucl Med Biol 1994;21(5):693-699.
[5] Horton KM, Sheth S, Corl F, et al. Multidetector row CT: principles and clinical applications. Critical Reviews in Computed Tomography 2002;43(2):143-181.
[6] Baum U, Greess H, Lell M, et al. Imaging of head and neck tumours-methods: CT, spiral-CT, multislice-spiral-CT. Eur J Radiol 2000;33(3):153-160.
[7] Greess H, Nomayr A, Tomandl B, et al. 2D and 3D visualization of head and neck tumours from spiral CT data. Eur J Radiol 2000;33(3):170-177.
[8] Frush DP, Donnelly LF. Helical CT in children: technical considerations and body applications. Radiology 1998;209(1):37-48.
[9] Som PM. The present controversy over imaging method of choice for evaluating the soft tissues of the neck. American Journal of Neuroradiology 1997;18(10):1869-1872.
[10] Bryan RN, Miller RH, Ferreyro RI, et al. Computed tomography of major salivary glands. AJR Am J Roentgenol 1982;139(3):547-554.
[11] Spiro RH, Huvos AG, Berk R, et al. Mucoepidermoid carcinoma of salivary gland origin. The American Journal of Surgery 1978;136(4):461-468.