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Role of Multidetector computed Tomograpgy in evaluation of Neck Masses

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Abstract:

Background &Method: Aim of this study is toevaluate Role of Multidetector computed Tomograpgy in evaluation of Neck Masses. TA prospective study of 60 patients with clinically suspected neck mass was done at our tertiary care hospital. Patients were referred for CT with clinical history/ USG findings of neck mass/ swelling for further characterisation. CT was done for the patients in NCCT and CECT phases. Patients were evaluated with Multi detector CT (TOSHIBA 128 SLICE system).

Result: Out of total 60 patient studied in this study, 32 (53.3%) patient were diagnosed malignant on CT one the basis of various CT characteristics which differentiate lesions between benign and malignant lesion. Out of total 32 patients which were diagnosed malignant, majority i.e. 26 (81.2%) were showing heterogeneous contrast enhancement. None of the malignant lesion were showing non enhancement or peripheral enhancement. 08 (26.6%) patients out of 28 benign lesions were demonstrating heterogenous enhancement. Homogenous enhancement were shown by 2 (7.1%) cases of benign lesion. More than half of the benign lesion were showing homogenous or peripheral enhancement i.e. 16 (58%). Majority of the malignant lesion i.e. 22 (68.8 5) were showing necrosis. Among benign lesion 5 (17. 8 %) cases out of total 28 patients were showing necrosis. Bony involvement in the form of lytic erosion were seen in 5 (15.6%) patients out of total 32 patients. No bony involvement were seen in benign lesion. Vascular involvement was seen in 3 (9.3%) patients of malignant lesions and 1 (3.1%) cases of benign lesion. Loss of fat planes with adjacent structure was mostly seen in malignant lesion (60%) as compared to benign lesion (7.1%).

Conclusion: Recently developed MDCT enables for thinner collimation with use of MPR, maximum intensity projection and shaded surface display images which improve the localization of the neck lesions. The faster scan acquisitions, less susceptibility to deleterious artifacts from patient motion, ability to be performed in patients with implanted electrical devices are its advantages. CT is a more practical imaging modality due to its relatively lower cost, making it more accessible to patients of lower socioeconomic strata. Since CT is fast, well tolerated, and readily available; it can be used for initial evaluation, preoperative planning, biopsy targeting, and post-operative follow-up and reserve MRI as a complimentary imaging modality or for those tumors that have higher chance of perineural spread.

Keywords: Multidetector, Tomograpgy, & Neck Masses.

Study Designed: Observational Study.

1. INTRODUCTION

The development of computerized tomography (CT) has been called the most important contribution to medical diagnostic techniques since Roentgen discovered the X-ray in 1895.
By the introduction of cross sectional imaging a new dimension in evaluation of neck lesions has evolved. CT is useful in evaluation of head and neck lesions such as lesions of nasopharynx, base of skull the larynx and neck areas. CT has added the horizontal plane in the evaluation of these lesions.
The ease of obtaining CT scans and rapid scan acquisition are its advantages. The transaxialorientation of CT planes is particularly useful in certain locations such as the pterygopalatine fossa. As technology advances in the use of CT, its application in head and neck lesions has increased.[1]
CT with its unique capacity to display osseous and soft tissue details has become an indispensible tool in evaluation of patients with neck mass.[2] MDCT scanning is rapidly replacing conventional dynamic CT scanning (slice-by-slice acquisition) in most medical centers. Spiral CT permits rapid scanning of large volumes of tissue during quiet respiration. MDCT is less susceptible to patient motion than conventional CT.[3] Volumetric helical data permits optimal multiplanar and 3D reconstructions.
Neck is a conical space that is situated between the base of skull upto the thoracic inlet. It is divided into suprahyoid and infrahyoid part by the hyoid bone. Traditionally the neck used to be classified based on triangles.[4] But with the advent of cross sectional imaging the concept of neckspaces has come into picture. The neck is divided into twelve spaces by the superficial and deep cervical fascia.[4]
MDCT is standard for imaging neck tumours. Secondary coronal reconstructions of axial scans are helpful in the evaluation of the crossing of the midline by small tumours of the tongue base or palate. MDCT allows almost isotropic imaging of the head and neck region and improves the assessment of tumour spread and lymph node metastases in arbitrary oblique planes. MDCT is especially advantageous in defining the critical relationships of tumour and lymph node metastases and for functional imaging of the hypopharynx and larynx not only in the transverse plane but also in the coronal plane. The rapid acquisition results in volumetric data set, reconstructed to a stack of thin and overlapping native images thus reducing partial volume averaging and motion artefacts. Furthermore full advantage of intravenous contrast agent is accomplished by optimal imaging between the injection and image acquisition.[5]
In every region of the head and neck MPRs are useful as additional planes. SSDs are useful if there is extensive bony destruction (skull, spine, skeleton larynx). Color-coded three-di mensional reformations may be done for extensive tumors and before multi-specialty surgery.

2. MATERIAL & METHOD

A prospective study of 60 patients with clinically suspected neck mass was done at our tertiary care hospital. Patients were referred for CT with clinical history/ USG findings of neck mass/ swelling for further characterisation. CT was done for the patients in NCCT and CECT phases. Patients were evaluated with Multi detector CT (TOSHIBA 128 SLICE system).
Institutional ethics committee clearance and approval of MUHS were obtained prior to the study. Written informed consent was obtained from the subject'sforinclusion of their images in the study, with standard disclosures (Appendix I and II).

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A total of 60 patients who were investigated betweenJanuary 2020 to October 2021 Duration of Study 01 Year 10 Months were included.
Detailed history taking and clinical examination were undertaken prior to the CT examination.

INCLUSION CRITERIA:

- All patients with neck mass referred to our department for CECT neck.
- Both gender of any age is included in the study.
- Those willing to participate in the study after consent.

EXCLUSION CRITERIA:

- Pregnant female.
- Patient with contraindication to IV administration to contrast medium.
- Impaired renal function test.
- Hemodynamically unstable patients.
- Patients refusing consent to be included in the study.

3. RESULTS

Table 1: DISTRIBUTION ACCORDING TO AGE

Age in years	Frequency	Percent %
0- 10	1	1.6
11-20	4	6.6
21-30	6	10
31-40	8	13.3
41-50	10	16.6
51-60	6	10
61-70	16	26.6
71-80	9	15
TOTAL	**60**	**100%**

We included total 60 patients in our study. Out of 60 patients, majority i.e. 16 (26.6%) were from 61-70 years, 10 (16.6.0%) from 41-50 years, 8 (13.3%) from 31-40 years,9 (15%) from 71-80 years, 8 (13.30%) from above 31-40 years, 6 (10.0%) from above 21-30 years and 51-60 years, 4 (6.6%) from above 11-20 years and least were from below 10 years i.e. 1 (1.6%). So in our study maximum percentage of patients were in the age group of 61- 70 years (26.6%).

Table 2: GENDER DISTRIBUTION OF NECK LESIONS (n=60)

Gender	Number	Percentage
Male	34	57%
Female	26	43%
Total	**60**	**100**

Outoftotal60patients,34(57%)weremaleand26(43%)werefemale.So thepresentstudyisshowingmalepreponderancewithmaletofemaleratioof1.3:1.

Table 3: DISTRIBUTION AMONG BENIGN AND MALIGNANT LESION

Mass	Number	Percentage
Benign	28	46.7
Malignant	32	53.3
Total	**60**	**100**

Outoftotal60patientsstudiedinthisstudy,34(53.30%)weremalignantand (46.70%) werebeing.

Table 4: VARIOUS NECK LESION DISTRIBUTION ACCORDING NECK SPACES

Space/Origin	Benign	Malignant	Total	Percentage
Submandibular / Sublingual space	7	4	11	18.3
Oral cavity	0	9	9	15
Parotid space	4	2	6	10
Carotid space	1	1	2	3.3
Visceral space	8	16	24	40

Masticator space	2	0	2	3.3
Posterior cervical space	4	0	4	6.6
Pharyngeal mucosal space	2	0	2	3.3
Total	**28**	**32**	**60**	**100**

We included total 60 patients, out of which 24 (38.3%) patients have pathology in visceral space, 11 (18.3%) patients in submandibular / sublingual space, 6 (10%) in parotid space and buccal space, 4 (6.6%) in posterior cervical space, 3 (5%) in oral cavity, 2 (3.3%) in masticator and pharyngeal mucosal space.

Majority of the benign and malignant lesion were seen in visceral space i.e. in 24 patients which include both benign and malignant lesion. Out of total 24 lesion in visceral space, 8 (24.4%) were benign and 24 (66.6%) were malignant, followed by submandibualrspacec which include total 11 patients, 7 (63.6 %) were bening and 4 (36.4%) were malignant. Least common space involved is pharyngeal mucosal space and masticator space i.e. 2 and both are of benign etiology. No malignant lesion was noted in posterior cervical space, pharyngeal mucosal space and masticator space.

Table 5: AMONG THE BENIGN LESION (n=28)

Lesion	Number	Percentage
Infection	13	46.2
Congenital	6	22.0
Inflammatory	7	25.1
Benign Neoplastic	2	7.1
Total	**28**	**100**

Inourstudyoutof28benignpatients,13(46.2%)wereofinfectiveetiology,6 (22%)wereofcongenitaletiology,7(25.1%)frominflammatoryandleast2were from benign neoplasticetiology.Soinourstudymostcommonbenignlesionisofinfectiveetiologyi.e.13 (46.2%).

Table 6: BENIGN NECK LESION DISTRIBUTION ACCORDING TO GENDER

Lesion	Male	Female	Total	Percentage (%)
Abscess	3	6	9	32.2
Benign thyroidlesion	1	4	5	17.9
Benign parotidlesion	1	0	1	3.6
Branchial fistula	1	1	2	7.1
Benign LN	0	1	1	3.6
Branchial cleft cyst	1	1	2	7.1
Lymphangioma	1	0	1	3.6
Lipoma	1	0	1	3.6
Ameloblastoma	1	0	1	3.6
Vascular malformation (AV fistula)	0	1	1	3.6
Thyroglossal duct cyst	0	1	1	3.6
Plunging ranulas	0	1	1	3.6
Mandible Osteomyelitis	2	0	2	7.1
Total	**12**	**16**	**28**	**100**

Outoftotal60patientsstudiedinthisstudy,28patientswerebenign.There isfemalepreponderanceseeninbenignascomparedtomalewithfemaletomale ration1.3:1.

Mostcommonbenignlesionnotedinourstudyisabscess9(32.2%)whichwasmorecommoninf emale,submandibulrspaceabscessismostamongthem, followedbybeibgnthyroidlesion5(17.9%)whichisagainmorecommoninfemale patients.

6patients(21.4%)wereofcongenitalordevelopmentaletiology.Branchial cleftcystandbrancialfistula2ofeachisseeninmaleandfemalepatientequally.1 patientsofthyroglossalductcystinfemaleandpatientoflymphangiomainmale patients wasseen.

Lipoma and plunging ranula was seen in male and female patients respectively. Ameloblastoma was seen in 1 male patient, mandible bone

osteomyelitiswasseenin2malepatients.VascularmalformationintheformofAV fistulawasseenin1femalepatient.Tubercularlymphadenopathywasnotedin1 femalepatientsandbenignparotidlesionintheformofpleomorphicadenomawas seenin1malepatients.

Table 7: AMONG THE MALIGNANT LESION (n=32)

Lesion	Number	Percentage
Larynx	4	12.5
Thyroid	8	25
Buccal mucosa	6	18.7
Salivary gland	4	12.5
Tongue	3	9.3
Lymphoma	2	6.2
Pharynx (oro and nasopharynx)	3	9.3
Paraganglioma	1	3.1
Ca esophagus	1	3.1
Total	**32**	**100**

Out of total 60 patients studied in this study, 32 (53.7%), most commonmalignantlesioninourstudywasthyroidcarcinoma,followedbybuccalmucosa carcinoma 6 (18.7%), 4 (12.5%) patients each of laryngeal carcinoma and salivaryglandtumor,3(9.3%)patientsofCatongueandpharynx,2(6.2%)patientsof lymphomaandleast1(3.1%)caseofparagangliomaandCaesophagus.

Table 8: MALIGNANT MASS LESION DISTRIBUTION ACCORDING TO GENDER

Lesion	Male	Female	Total	Percent
Thyroid	3	5	8	25
Oral cavity	9	0	9	28.1
Larynx CA	3	1	4	12.5
Salivary gland	2	2	4	12.5
Oroparyngeal CA	2	1	3	9.4
Nasopharyngeal CA	1	0	1	3.1
Paraganglioma	1	0	1	3.1
Lymphoma	2	0	2	7.2
Total	**23**	**9**	**32**	**100**

Outoftotal32malignantlesion,23(71.8%)wereseeninmalepatientsand 9(28.2%)wereseeninfemalepatients.Mostcommonamongthemalignantlesion wereoralcavitycarcinoma(28.1%)whichwereexclusivelyseeninmalepatients, followedbythyroidcarcinomai.e.8(25%),whichwerepredominantlyseenin5 femalepatientsand3inmalepatients.Salivaryglandtumorwasseenin4(12.5%) patients2bothinmaleandfemale.Oropharngealcarcinomawereseenin3(9.4%) patients2inmaleand1infemalepatients.Lymphomawasseenin2(7.2%)bothin malepatient.Nasopharyngealcarcinomawasseenin1(3.1%)patients.

Table 9: TABULATION OF LESION ACCORDING TO LESION CHARACTERISTICS

Feature	Benign (n=28)		Malignant (n=32)	
	Number	Percentage	Number	Percentage
Homogeneous enhancement	2	7.1	2	6.2
Heterogeneous enhancement	8	28.6	26	81.2
Peripheral enhancement	8	2.6	0	0

No enhancement	2	7.1	0	0
Necrosis	5	17.8	20	68.8
Irregular margin	5	17.8	14	43.7
Bony invasion	0	0	5	15.6
Vascular invasion	1	3.4	3	9.3
Loss of fat planes	2	7.1	19	60
Lymphadenopathy	9	35.5	15	50
Calcification	5	17.8	7	25.8

Out of total 60 patient studied in this study, 32 (53.3%) patient were diagnosed malignant on CT one the basis of various CT characteristics which differentiate lesions between benign and malignant lesion.
Out of total 32 patients which were diagnosed malignant, majority i.e. 26 (81.2%) were showing heterogeneous contrast enhancement.
None of the malignant lesion were showing non enhancement or peripheral enhancement.
8 (26.6%) patients out of 28 benign lesions were demonstrating heterogenous enhancement.
Homogenous enhancement were shown by 2 (7.1%) cases of benign lesion. More than half of the benign lesion were showing homogenous or peripheral enhancement i.e. 16 (58%).
Majority of the malignant lesion i.e. 22 (68.8 5) were showing necrosis. Among benign lesion 5 (17. 8 %) cases out of total 28 patients were showing necrosis.
Bony involvement in the form of lytic erosion were seen in 5 (15.6%) patients out of total 32 patients. No bony involvement were seen in benign lesion.
Vascular involvement was seen in 3 (9.3%) patients of malignant lesions and 1 (3.1%) cases of benign lesion.
Loss of fat planes with adjacent structure was mostly seen in malignant lesion (60%) as compared to benign lesion (7.1%).
Lymphadenopathy was seen in more than half of the malignant lesion i.e. 19 (60 %). Benign lesion showing lymphadenopathy were fewer in number i.e. 10 (35.5%).
Calcification is seen mostly in malignant lesion i.e. 8 cases (25.8%) and 2 cases (6.8 %) in benign lesion.

4. DISCUSSION

In the current study the age of the ranged from 1-80 years with mean age of 50.3 years. Majority of the age group in this study was 61-70 years which is comparable to a study conducted by Mathur R et al[6] Most (70%) of the benign lesions of the head and neck region was below the age of 50 year. Majority of the malignant lesion were above the age of the 50 years except few cases of lymphoma and oral cavity carcinoma who were less than 40 years.

A similar study done by Otto RA et al[7] states that most of the benign lesions of neck occur in pediatric and young adults group and most of the malignant conditions occur in the elderly population.

In another similar study done by Ravimerhotra et al (2005)[8] showed that the prevalence of head and neck malignancy was highest in patients of elderly population.

A study done by Ozkiris M. et al[9] also showed that in neck masess, neoplasm should be considered in older adults and inflammatory and congenital masse in children and young patients.Significant number patients i.e. 18 out of 32 (56.6%) malignant lesion have will defined margin on CT which is in agreement to study done by Thakkar et al[10]. In our study necrosis was present in (60 %) malignant lesions patients. In a similar study done by C. Eskey et al (2000)[11] state that necrosis is more frequently seen in malignant lesions[12]. In our study most of the malignant lesion 81.2% shows heterogenous enhancement. Exceptions are noted in 2 (7%) cases, one case of lymphoma and one case of paraganglioma which showed homogenous enchancncment pattern. None of the malignant lesions were non-enhancing or peripherally enhancing which is in agreement with the study done by Balakrishnan K. et al[13]

Benign lesion consisted of all types of enhancement patterns with majority showing Heterogenous and perioheralenhcncement and necrosis was also noted in some benign lesion.Bone erosion found to be highly specific feature for malignancy. In the present study bony infiltration involvement was seen in 5 cases (15.6%) of the malignant lesion diagnosed by CT. The findings of osseus involvement in our cases included cortical lytic erosion adjacent to primalry lesion, predominantly in oral cavity carcinoma.

A similar study done by Bagele et al[14] also corresponds to our study who found significant involvement of bony invasion in oral cavity carcinoma.

In our study out of total 60 patients vascular involvement was noted in 04 patients (6.6%) out of which 03 (5%) cases were malignant and 01 case was of benign etiology (abscess). Among the malignant lesion, 1 case of thyroid carcinoma and submandibualr gland carcinoma were seen which was invading left internal jugular vein and right internal jugular vein with its non-visualization respectively. Another 1 case of thyroid carcinoma shows non enhancing thrombus in left internal jugular vein superiorly extending upto sigmoid sinus and left transverse sinus. In benign lesion one case of parotid abscess shows complete lumen occluding thrombus was seen involving external jugular vein in intra-parotid part.

A study done by S. Kaur et al[15] also showed similar involvement of vessels in her study in which total 4 cases were having vascular involvement, 2 were from benign and 2 from malignant etiology.

Loss of fat planes was seen in significant number in malignant lesion (60%) as compared to benign lesion (7.1%).

In the present study 24 patients out of 60 present with cervical lymphadenopathy. More than half of them (n=15) were due to metastatic secondary to with a known primary in head and neck region. Two cases of lymphoma and 1 case of case tubercular lymphadenopathy were also diagnosed. Other (n=6) were reactive lymphadenopathy due to infective etiology.

5. CONCLUSION

The accuracy of MDCT to predict benign or malignant lesion of the neck massed was observed to be high. Contrasr enhanced CT has improved the localization and characterization of the neck lesion.

If there is an accurate delineation of disease by CT scan provides a reliable pre-operative diagnosis, plan for radiotherapy ports and post-treatment follow-up. The most important advantage lies in it, is ability to detect bony lesions (erosions and expansion). Recently

developed MDCT enables for thinner collimation with use of MPR, maximum intensity projection and shaded surface display images which improve the localization of the neck lesions. The faster scan acquisitions, less susceptibility to deleterious artifacts from patient motion, ability to be performed in patients with implanted electrical devices are its advantages. CT is a more practical imaging modality due to its relatively lower cost, making it more accessible to patients of lower socioeconomic strata. Since CT is fast, well tolerated, and readily available; it can be used for initial evaluation, preoperative planning, biopsy targeting, and post-operative follow-up and reserve MRI as a complimentary imaging modality or for those tumors that have higher chance of perineural spread.

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