RESEARCH PAPER

Role of Multidetector Computed Tomography in the Evaluation of Neck Lesions

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ABSTRACT

Imaging of the neck has traditionally presented diagnostic challenges due to the region's complex anatomy. Multidetector computed tomography (MDCT) offers distinct advantages by clearly depicting both soft tissue and bony structures while providing essential anatomical detail. Its speed, thin collimation, multiplanar reconstruction capabilities, and ease of use make it the preferred diagnostic modality for evaluating neck lesions. This prospective cross-sectional study aimed to assess the role of MDCT in detecting and characterizing neck lesions based on anatomical location, morphology, enhancement patterns, and the extent of involvement of adjacent structures, including bony or vascular invasion and lymphadenopathy. The study included 50 patients with clinically or sonographically suspected neck lesions referred for CT Neck between August 2024 and January 2025. Scanning was performed using a Siemens SOMATOM go.UP 64-slice CT scanner. Of the 50 cases, 26 (52%) were malignant, 8 (16%) benign, 6 (12%) inflammatory, 5 (10%) suspicious/unclear, and 3 (6%) categorized as others. Neck lesions were more prevalent in males (59.3%) and in the 51–60-year age group (23.7%). The buccal space was the most commonly involved region (18%), followed by the visceral space (16%) and pharyngeal mucosal space (14%), with carcinoma of the buccal mucosa being the most frequent lesion. In conclusion, MDCT proved to be a valuable and accessible tool for localizing and characterizing neck lesions. Its ability to provide contrast-enhanced, high-resolution multiplanar images enhances lesion detection and evaluation, supporting its role as a reliable imaging modality in the comprehensive assessment of neck pathologies.

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INTRODUCTION

The neck is a complex anatomical region that extends from the base of the skull to the thoracic inlet and houses a multitude of vital structures including muscles, glands, blood vessels, lymphatic tissue, and portions of the respiratory and digestive tracts[1]. Lesions in this region can arise from a wide range of etiologies benign, malignant, congenital, inflammatory, or infectious and may involve nodal or non-nodal structures[2]. The clinical presentation of neck lesions is often nonspecific, and due to the overlapping symptoms and deep location of many structures, clinical examination alone is frequently insufficient for accurate diagnosis[3].

Imaging plays a pivotal role in the evaluation of neck masses. While ultrasonography is commonly used as an initial screening tool because of its non-invasiveness, cost-effectiveness, and accessibility, it has limitations in evaluating deep tissue planes, assessing bone involvement, and visualizing complex anatomic relationships[4]. Magnetic resonance imaging (MRI) provides excellent soft tissue contrast and multiplanar imaging, but its availability, higher cost, longer scan times, and patient cooperation requirements often limit its use, especially in emergency or resource-limited settings[5].

Multidetector computed tomography (MDCT), with its rapid image acquisition, high-resolution images, and multiplanar reformatting capabilities, has emerged as a highly effective imaging modality for evaluating neck lesions[8]. It allows precise assessment of lesion size, location, morphology, enhancement pattern, involvement of adjacent structures, bony invasion, vascular encasement, and lymph node status[11]. These characteristics are crucial not only for diagnosis but also for staging, surgical planning, radiotherapy, and follow-up evaluation[7].

This study aims to explore the role of MDCT in the detection and characterization of neck lesions in a clinical setting[12]. By evaluating lesions based on anatomical location, morphological features, enhancement patterns, and involvement of adjacent

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tissues or lymph nodes, this research seeks to underline the diagnostic accuracy and clinical utility of MDCT as a primary imaging modality in the comprehensive assessment of neck pathologies[15].

METIRIALS AND METHOD:

This was a prospective cross-sectional study conducted at West Central Railway Hospital, Jabalpur, Madhya Pradesh (A PPP mode of Eskag Sanjeevani) over a period of 1 st August 2024 to 31 January 2025. This Study included 50 patients who had undergone CT Neck (NCCT and CECT). There were 35(70%) males and 15(30%) female's patients, ranging in age from 22 to 81 years (mean, 51.5 years). Several CT technologists performed all examinations in a standardized way. And I have collected data from 50 patients for this project. Patients were selected who met the inclusion and exclusion criteria.

Study Design: Prospective Cross Sectional Study.

Study Location: West Central Railway Hospital, Jabalpur, Madhya Pradesh (A PPP mode of Eskag Sanjeevani)

Study Duration: August 2024 to January 2025

Sample Size: 50

Inclusion Criteria:

1. Patients with suspected neck mass.

2. Patients in whom a neck lesion was detected on ultrasound study.

3. Patients presenting with symptoms relating to neck area.

Exclusion Criteria:

1. Patients with history of trauma related neck swelling.
2. Pregnant patients.
3. Patients with history of surgeries which alters the anatomy of neck.
4. Patients who deny consent.

Equipment Used for Study:

Siemens SOMATOM go. UP, 64 Slices (Max 192) CT Scanner, Multidetector Computed Tomography (MDCT)

Scanning Technique:

Position of the Patient: Supine and both arms next to the body with shoulder pulled down.

Topogram Direction: Cranio-caudal

Landmark: Glabella (Part of the forehead above and between the eyebrows)

Start Location: Base of Skull

End location: Thoracic outlet

Field Of View (FOV): 140-200 mm

Thickness: 5 mm (Reconstructed to 1.50 mm)

Tube Voltage (KV): 120 -150

Tube Current (mAs): 100 -200

Respiration: Single breath-hold (Inspiration) / OR Puffed cheeks

Patients were kept nil per oral 4 hours prior to CT scan to avoid complications while administering contrast medium. Risk of contrast administration were explained to the patient and consent was taken prior to the contrast study. Routine lateral tomogram of the neck was taken in all patients in supine position with head in extended position. In all patients, Plain study was done using 5 mm axial sections and reconstructions to 1.50 mm thinner sections. Contrast study was done using IV contrast Iohexol (Contrapaque 350) 1 ml per kg body weight and images were taken in arterial and venous phase. Newer techniques such as maximum intensity projections and Minimum intensity projections were done as and when necessary. Scans will be reviewed in appropriate windows like mediastinal window, laryngeal window and bone window. The pathological lesions will be evaluated with respect to the size of the lesion, location of the lesion, enhancement pattern, presence of calcification, presence of fat, extension into adjoining structures and presence or absence of vascular and bony involvement.

RESULTS:

In the present study maximum percentage of patients were in the age group of 41-50 years (22%) followed by 71-80 years (20%) and 51-60 years (18%) as shown in Table 1. The present study shows male preponderance (70%) with male to female ratio of 2.33:1 as shown in Table 2. Out of 50 cases studied 26 (52%) were malignant, 08 (16%) were benign and 06 (12%) were inflammatory aetiology and 02(4%) were congenital aetiology 05(10%) were suspicious/unclear and 03(6%) were others as shown in Table 4. Most common benign neck mass was seen in the age group of 21-30 years. The current study shows higher incidence of benign neck mass among females with a female to male ratio of 1.67:1 as shown in Table 7. The current study shows higher incidence of malignant lesions between 41-50 years followed by 61-70 years and 71-80 years age groups. Higher incidence among males was noted with a male to female ratio of 4.2:1 as shown in Table 8. Most common benign lesion in this study found that thyroid nodule. The most common malignant lesions in this study found Carcinoma of the buccal mucosa followed by Carcinoma of retromolar trigone and Carcinoma of pharynx/Larynx.

Table 1: Age Distribution of Study Participants (N = 50)

Age Group (yrs)	Male		Female		Total	
	No	Percentage(%)	No	Percentage(%)	No	Percentage(%)
21 - 30	1	2	4	8	5	10
31 - 40	8	16	0	0	8	16
41 - 50	5	10	6	12	11	22
51 - 60	7	14	2	4	9	18
61 - 70	6	12	1	2	7	14
71-80	8	16	2	4	10	20
Total	35	70	15	30	50	100

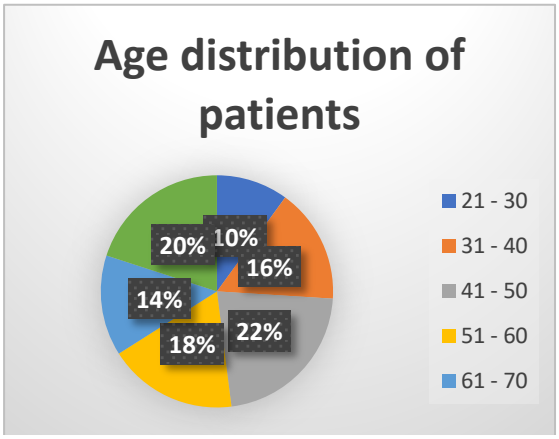

Figure 2: Age Distribution of Study Participants

Represents the distribution of patients according to age starting from the 21-30 years old with 05 patients having (10%) after that 31-40 years old 08 patients having (16%) after that 41-50 years old 11 patients having (22%) after that 51-60 years old 09 patients having (18%) after that 61-70 years old 07 patients having (14%) after that 71-80 years old 10 patients having (20%) as shown in fig-1. Most no of patients age starts from 41-50 years old 11 patients with percentage of (22%).

Table 2: Gender Distribution of Study Participants (N = 50)

Gender	Number of Participants (N=50)	Percentage (%)
MALE	35	70.00%
FEMALE	15	30.00%

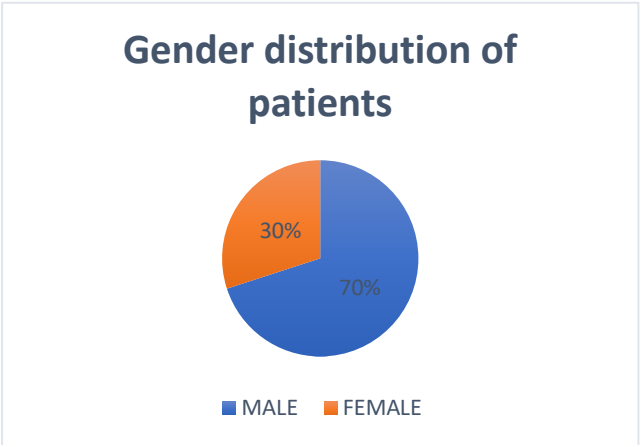

Figure 3: Gender Distribution of Study Participants

Represents distribution of patients according to gender (male/female), We have 50 patients in which 35 (70%) are males and 15 (30%) are females. We have a greater number of males than females with male to female ratio of 2.33:1.

Table 3: Distribution of Clinical Symptoms of Study Participants

Clinical symptoms	Number of patients (n=50)	Percentage (%)
Pain	26	52.00%
Swelling	31	62.00%
Dysphagia	17	34.00%
Others	16	32.00%

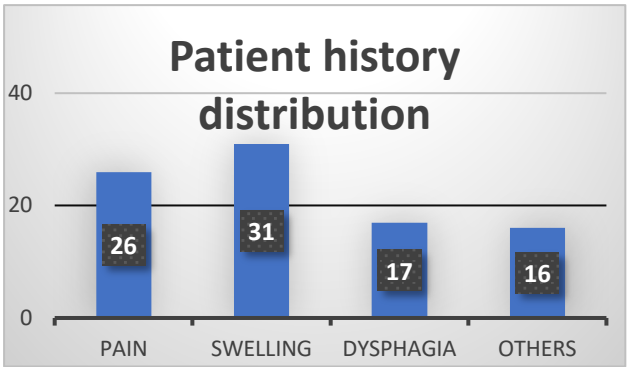

Figure 4: Distribution of Clinical Symptoms of Study Participants

Represents the distribution of patients according to the participants clinical symptoms. Among the 50 participants, 37 (62.00%) of participants were having swelling and 26 (52.00%) are suffering from Pain and 17 (34.00%), 16(32.00%) participants complained of Dysphagia and others various symptoms respectively.

Table 4: Distribution Of Neck Masses According to Lesion Nature/ Aetiology

Lesion Nature	Frequency (N=50)	Percentage (%)

Benign Neoplastic Aetiology	08	16
Malignant Neoplastic Aetiology	26	52
Inflammatory Aetiology	06	12
Congenital Aetiology	02	04
Suspicious/Needs Correlation	05	10
Others (No Lesion)	03	06

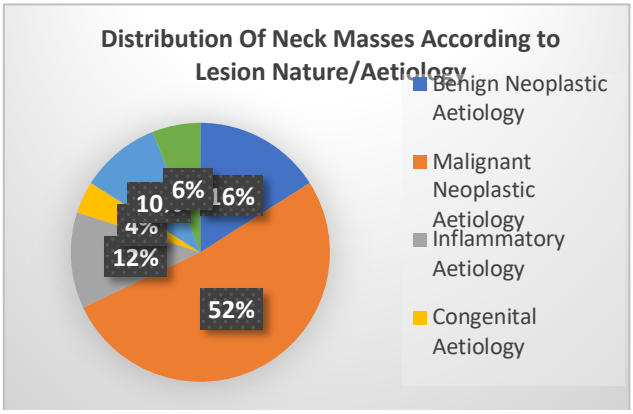

Figure 5: Distribution Of Neck Masses According to Lesion Nature/ Aetiology

Represents the distribution of neck masses according to lesion nature. Out of 50 cases studied, 08(16%) were diagnosed as Benign Neoplastic Aetiology and 26(52%) were Malignant Neoplastic Aetiology and 06(12%) were Inflammatory Aetiology and 02(04%) were Congenital Aetiology and 05(10%) were Suspicious/Needs Correlation and 03(06%) were others/No Lesion.

Table 5: Anatomical Location of Neck Masses

Anatomical Location	Number of Cases(N=50)	Percentage (%)
Pharynx	06	12
Larynx	07	14
Oral Cavity/Buccal Mucosa	14	28
Thyroid Gland	12	24
Parotid/Submandibular Gland	01	02
Lymph Node	05	10
Thyroglossal Duct	03	06
Mandible/Alveolus	01	02
Tonsil/Tonsillar Region	01	02

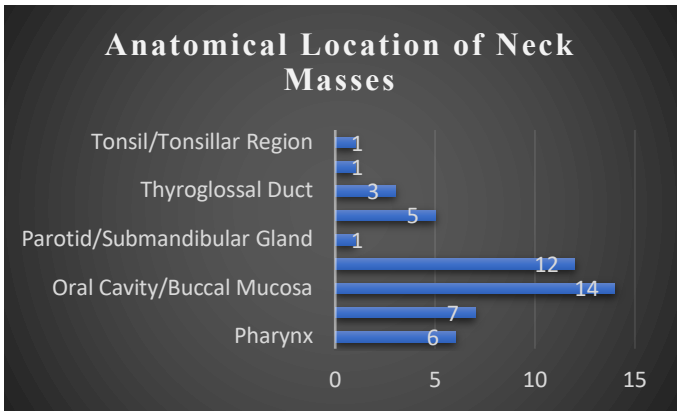

Figure 6: Anatomical Location of Neck Masses

Table 6: Distribution Of Neck Masses Based on Neck Spaces Involved

Location of Neck Space	Number of Cases	Percentage (%)
VS	8	16
BS	9	18
MS	4	08
PMS	7	14
PCS	4	08
SMS	7	14
SSSB	4	08
PEVS	4	08
CS	4	08
PPS	4	08
PS	5	10

VS: Visceral space, BS: Buccal space, MS: Masticator space, PMS: Pharyngeal mucosal space, PCS: Posterior cervical space, SMS: Submandibular Space, SSSB: Suprasternal space, PEVS: Perivertebral space, CS: Carotid space, PPS: Parapharyngeal space, PS: Parotid space.

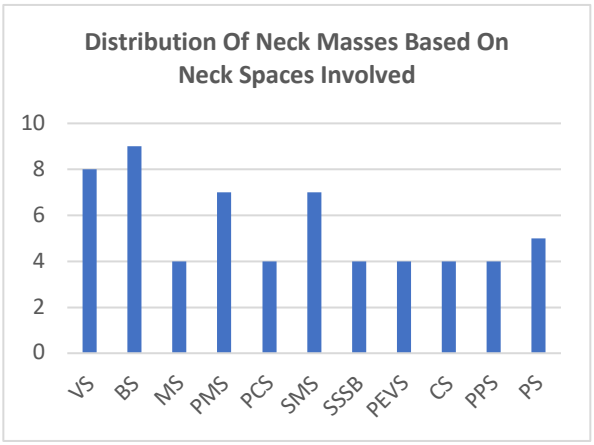

Figure 7: Distribution Of Neck Masses Based On Neck Spaces Involved

The most common neck space involved was Buccal space (18%) followed by Visceral space (16%) and Pharyngeal mucosal space (14%).

Table 7: Age and Gender Distribution of Benign Lesions (N=08)

Age Group (yrs)	Gender		Total	
	Male	Female	No	%
<20	0	0	0	0
21 - 30	1	3	4	50
31 - 40	0	0	0	0
41 - 50	1	0	1	12.5
51 - 60	0	0	0	0
61 - 70	2	1	3	37.5
>71	0	0	0	0
Total	4	4	8	

Table 8: Age and Gender Distribution of Malignant Lesions (N=26)

Age Group (yrs)	Gender		Total	
	Male	Female	No	%
<20	0	0	0	0
21 - 30	0	0	0	0
31 - 40	3	2	05	19.23
41 - 50	5	1	06	23.08
51 - 60	5	0	05	19.23
61 - 70	4	1	05	19.23
>71	4	1	05	19.23
Total	21	5	26	

Table 9: General MDCT Characteristics of Neck Lesions Studied.

Benign Lesion		Number of Cases (N=50)	Percentage (%)
Margins	Well-defined	16	32
	Ill-defined	34	68
Calcification	Present	06	12
	Absent	44	88
Enhancement	Enhancing	34	68
	Non-enhancing	16	32
Adjacent organization	Present	33	66
	Absent	17	34
Lymph node	Present	34	68
	Absent	16	32
Bone invasion	Present	04	08
	Absent	46	92
Vascular invasion	Present	02	04
	Absent	48	96
Soft tissue infiltration	Present	03	06
	Absent	47	94
Necrosis	Present	06	12
	Absent	44	88

Out of 50 cases, 16 (32%) had Well-defined and 34 (68%) had Ill-defined margins. Adjacent organ invasion was seen in 33 (66%) of the cases. 04 cases showed bone invasion, whereas only 02 of the lesions showed adjacent vascular invasion and Lymphadenopathy was seen in 34(68%) of cases.

Table 10: MDCT (NCCT & CECT) Characteristics of Benign Lesions

Benign Lesion		Number of Cases (N=08)
Margins	Well-defined	3
	Ill-defined	5
Calcification	Present	1
	Absent	7
Enhancement	Enhancing	4
	Non-enhancing	4
Adjacent organization	Present	3
	Absent	5
Lymph node/ Lymphadenopathy	Present	4
	Absent	4
Bone invasion	Present	0
	Absent	8
Vascular invasion	Present	1
	Absent	7
Soft tissue infiltration	Present	0
	Absent	8
Necrosis	Present	0
	Absent	8

Out of 08 Benign lesions cases, most of lesions show non-enhancing to mild enhancement without any significant bony or vascular invasion, necrosis and involvement of adjacent structures. Some of cases show lymph node involvement.

Table 11: MDCT (NCCT & CECT) Characteristics of Malignant Lesions

Benign Lesion		Number of Cases (N=26)	Percentage (%)
Margins	Well-defined	04	15
	Ill-defined	22	85
Calcification	Present	01	04
	Absent	25	96
Enhancement	Enhancing	23	88
	Non-enhancing	03	12
	Present	25	96

Adjacent organization	Absent	01	04
Lymph node/ Lymphadenopathy	Present	20	84
	Absent	06	16
Bone invasion	Present	03	12
	Absent	23	88
Vascular invasion	Present	00	00
	Absent	26	100
Soft tissue infiltration	Present	03	12
	Absent	23	88
Necrosis	Present	04	15
	Absent	22	85

Out of 26 malignant lesions cases, most of the lesion show enhancement (heterogenous enhancement), ill-defined margins with bony invasion and extension into adjacent structures/ spaces and lymph node involvement.

Table 12: Enhancement Pattern In CT

Enhancement Pattern	Benign(N=08)	Malignant (N=26)	Others(N=16)
Heterogonous (HET)	01	18	03
Homogenous (HOMO)	00	00	00
Non-enhancing (NON EN)	04	03	08
Rim Enhancement (RIM)	00	00	00
Mild Enhancement (ME)	03	05	04

HET: Heterogonous, HOMO: Homogenous, ME: Mild enhancement, NON EN: Non enhancing, RIM: Rim enhancement, CT: Computed tomography.

Table 13: Distribution Of Involved Lymph Node by Neck Station Levels

Lymph node levels	Number of Cases(%)
I (IA&IB)	24 (48)
II (IIA&IIB)	25 (50)
III	11 (22)
IV	05 (10)
V (VA&VB)	03 (06)
VI	01 (02)
VII	01 (02)

In the study it was seen that the level II(IIA&IIB) lymph nodes were the most commonly involved accounting for 50% of the cases followed by the level I – 48%, level III – 22%, level IV – 10%, level V – 6%, with level VI and VI being the least common lymph node station, accounting for 2% of cases respectively as shown in Table 10.

DISCUSSION:

This Prospective study- Cross sectional study was conducted to evaluate the role of MDCT in detection and characterization of neck masses. The study participants most belongs to age group of 41-50 years (22%) followed by 71-80 years (20%), 51-60 years (18%), 31-40 years (16%), 61-70 years (14%) and 21- 30 years (10%). Out of 50 cases, almost half (68%) had ill-defined margins and 32% had well-defined margins, 12% had calcification and 68% had enhancement and lymph node involved. Adjacent organ invasion was seen among 66%, 04% had vascular invasion and 08% had bone invasion. Where among the benign lesion cases, most of lesions show non-enhancing to mild enhancement without any significant bony or vascular invasion, necrosis and involvement of adjacent structures. Some of cases show lymph node involvement. Out of 26 malignant lesions, almost all 85% had ill defined margins and enhancement, 96 % showed adjacent organ invasion and 12% showed bone invasion and 15% showed necrosis. Regional lymphadenopathy was seen in 84% of the malignant lesions. Most of the lesions in our study were malignant lesion (52%) followed by benign (16%) while lesions with inflammatory aetiology was seen in 12%. Similarly in study done by Dr. Nazar A et al, more than half (66%) lesions were malignant while 22% of the lesions were benign. and 11.9% were inflammatory aetiology. (2,12) The common space involved in our study was Buccal space(18%) followed by Visceral space (16%) and Pharyngeal mucosal space (14%). In similar study done by Dr. Nazar A et al and Balakrishnan K, most common neck space involved was buccal space followed by visceral space and pharyngeal mucosal space. (2,6) In our study it was seen that the level II(IIA&IIB) lymph nodes were the most commonly involved accounting for 50% of the cases followed by the level I – 48%, level III – 22%, level IV – 10%, level V – 6%, with level VI and VI being the least common lymph node station, accounting for 2% of cases respectively , which is similar to study done by Gupta K et al.

CONCLUSION:

This study concludes that multidetector computed tomography is effective for localizing and characterizing neck lesions. The recently developed Multidetector CT (MDCT) allows for smaller collimation using MPR, MIP, and SSD images, improving localization of neck lesions. CT is a useful imaging technique for initial evaluation, preoperative planning, biopsy targeting, and postoperative follow-up because to its quick collection, well-tolerance, and accessibility. Although CT is not completely accurate, histopathology remains the gold standard.

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