INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

DIAGNOSTIC ACCURACY OF COMPUTED TOMOGRAPHY IN DETECTION OF MEDIASTINAL LYMPHOMA TAKING HISTOPATHOLOGY AS GOLD STANDARD

Original Research

Adnan Ahmed[1], Ayesha Amjad[2]*, Amjad Ali[3], Ghazala Wahid[4], Rabeea Ihtesham[5], Munazza Kainat Shuja[6], Shandana Khan[7], Muneeba Javed[8], Mahrukh Abdullah[9]

[1]Associate professor, Department of Radiology, Hayatabad Medical Complex, Peshawar, Pakistan.
[2]Postgraduate trainee, Department of Radiology, Hayatabad Medical Complex, Peshawar, Pakistan.
[3]Assistant Professor, Department of Surgery, Khyber Medical University Hospital, Peshawar, Pakistan.
[4]Associate professor, Department of Radiology, Hayatabad Medical Complex, Peshawar, Pakistan.
[5]Postgraduate trainee, Department of Radiology, Hayatabad Medical Complex, Peshawar, Pakistan.
[6] Postgraduate trainee, Department of Radiology, Hayatabad Medical Complex, Peshawar, Pakistan.
[7]Assistant professor, Department of Radiology Northwest general hospital and research centre, Peshawar, Pakistan.
[8]Postgraduate trainee, Department of Radiology, Abbottabad medical complex, Peshawar, Pakistan.
[9]Postgraduate trainee, Department of Radiology, Hayatabad Medical Complex, Peshawar, Pakistan.

Corresponding Author: Ayesha Amjad, Postgraduate trainee, Department of Radiology, Hayatabad Medical Complex, Peshawar, Pakistan, ayesha.presentations@gmail.com

Acknowledgement: We acknowledge the Radiology and Pathology Departments for their essential support in conducting this diagnostic accuracy study.

Submission: 30 March, 2025 Acceptance: 30 April, 2025 Publication: 05 May, 2025

Conflict of Interest: None Grant Support & Financial Support: None

ABSTRACT

Objective: To assess the diagnostic accuracy of computed tomography (CT) in detecting mediastinal lymphoma, with histopathology serving as the gold standard.

Methodology: This cross-sectional validation study was conducted on 138 patients suspected of mediastinal lymphoma who were presenting with symptoms such as night sweats, weight loss, and cervical swelling. Patients underwent CT scanning after intravenous contrast administration which was followed by histopathological examination. The CT scans were analyzed for mediastinal lymphoma while the histopathological findings served as the gold standard.

Results: Mean age was 38.17 ± 12.92 years while 81 (58.7%) patients were male. The CT showed sensitivity 77.92%, specificity 88.52% with positive predictive value 89.55%, and negative predictive value 76.06%. The diagnostic accuracy of CT in detecting mediastinal lymphoma was around 82.61%.

Conclusion: CT is a reliable imaging technique for the detection of mediastinal lymphoma with high specificity and diagnostic accuracy.

Keywords: Computed Tomography, Mediastinal Lymphoma, Diagnostic Accuracy, Histopathology, Sensitivity, Specificity.

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

INTRODUCTION

Lymphomas are characterized as an array of hematologic malignancies that arise from the uncontrolled proliferation of cells originating in lymphoid tissues. The two main kinds of lymphomas are Hodgkin's Lymphoma and Non-Hodgkin Lymphoma, which encompass a varied group of diseases involving either B cells, T cells, or natural killer lymphocytes. [1, 2] Lymphomas typically manifest through the enlargement of one or more lymph nodes, leading to painless, rubbery lumps beneath the skin. The abdomen and mediastinum are the most commonly affected areas; nonetheless, involvement in various other organs is also possible. The rapid proliferation of lymphomas frequently necessitates swift therapeutic interventions. Mediastinal tumors can lead to compression of the great vessels in chest, resulting in Superior Vena Cava Syndrome, which is marked by plethora and swelling of the face, neck, and upper extremities. Compression of the esophagus can result in dysphagia.[3]

Computed tomography (CT) is a vital imaging modality for the diagnosis, staging, as well as therapy of various malignancies, especially mediastinal lymphoma. Mediastinal lymphoma, a specific subtype of lymphomas primarily affecting the lymphatic tissue in the central thoracic region, poses unique challenges in terms of diagnosis and treatment. [4, 5] The significant positioning of mediastinal structures is primarily responsible for this, as they include vital organs such as the heart, lungs, significant blood vessels, as well as trachea. The mediastinum is divided into anterior, middle, and posterior compartments and is a common site for Hodgkin lymphoma. These lymphomas can present with various clinical symptoms; however, many patients may initially be asymptomatic or display nonspecific signs, highlighting the necessity for early and accurate detection. [6-8] A study indicated that the frequency of mediastinal lymphoma is 47.1% [9], while another study reported the sensitivity of computed tomography at 75% and specificity at 89.9% in the detection of mediastinal lymphoma. [10]

CT imaging plays a pivotal role in the initial evaluation by providing detailed anatomical information, allowing for assessment of mediastinal masses. Due to paucity of literature on this subject locally, the aim of this study is to determine the diagnostic accuracy of computed tomography in detection of mediastinal lymphoma taking histopathology as gold standard at our hospital setup. The findings of this study will be helpful for our medical professionals in highlighting the importance of CT, as CT imaging serves, a vital non-invasive tool in the comprehensive management of mediastinal lymphoma, contributing significantly to improved patient outcomes through accurate initial assessment and ongoing therapeutic monitoring.

METHODOLOGY:

The study was conducted as a cross-sectional validation study at the Department of Diagnostic Radiology, Hayatabad Medical Complex, Peshawar 28-Sept-2024—28-March-2025 after taking ethical approval from our hospital. The sample was selected on the basis of prior frequency of mediastinal lymphoma of 47.1%, CT sensitivity of 75% and a specificity of 89.9%[10] with confidence level 95% and margin of error 10%, a consecutive non-probability sampling technique was used for participant selection.

We enrolled 138 patients of either gender who had ages between 18 and 65 years, they were suspected of having mediastinal lymphoma based on clinical indications such as night sweats, weight loss and swelling in the cervical region. Patients with a history of post-radiation or post-chemotherapy treatment, pregnant or lactating women, patients with thymic tumors, patients diagnosed with Hodgkin lymphoma and patients with sarcoidosis were not included.

Informed consent was gained from all patients. Demographic data was gathered from the patients. All enrolled patients had to go through CT scanning using the Toshiba Asteion Multislice CT scanner following the administration of intravenous contrast. A non-ionic iodinated contrast was administered at a dose of 1.5 to 2.0 ml/kg using a power injector set at 2.0 ml/sec. The scanning parameters included a 3mm section thickness with a 3mm reconstruction interval and a scan delay of 80 seconds, 450 mAs and 100 to 150 kV. The CT images were later analyzed, and findings were documented. Afterwards the histopathological evaluation was performed. Both the CT and histopathology findings were then compared. A pre-designed proforma was used to record patient details and all evaluations were supervised by a consultant having at least five years of post-fellowship experience.

We used SPSS 25 to analyze the data obtained from the patients and the procedures. Variables such as age, height, weight and BMI were calculated using mean and SD. Demographics along with CT and histopathology findings were calculated using frequencies and percentages. We assessed diagnostic accuracy using a 2x2 contingency table.

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

RESULTS:

The study involved a total of 138 participants. The mean age was 38.17 ± 12.92 years. The body mass index (BMI) of the participants ranged from 22.31 to 30.86 kg/m² with a mean of 25.67 ± 2.34 kg/m². There were 81 (58.7%) male while 57 (41.3%) female patients. The demographic profile of the patients can be seen at table no 1.

The diagnostic performance of computed tomography (CT) showed that 67 (48.6%) participants had a positive CT result for mediastinal lymphoma while 71 (51.4%) had a negative CT result. Histopathological examination showed that 77 (55.8%) participants were positive for mediastinal lymphoma while 61 (44.2%) were negative (Table 2).

The diagnostic accuracy of CT for mediastinal lymphoma was 82.61%. The sensitivity of CT was 77.92% while its specificity was 88.52%. The positive predictive value (PPV) of CT was 89.55% while the negative predictive value (NPV) was 76.06% (Table 3). Stratification of diagnostic accuracy with various parameters can be seen from table no 4 to 10.

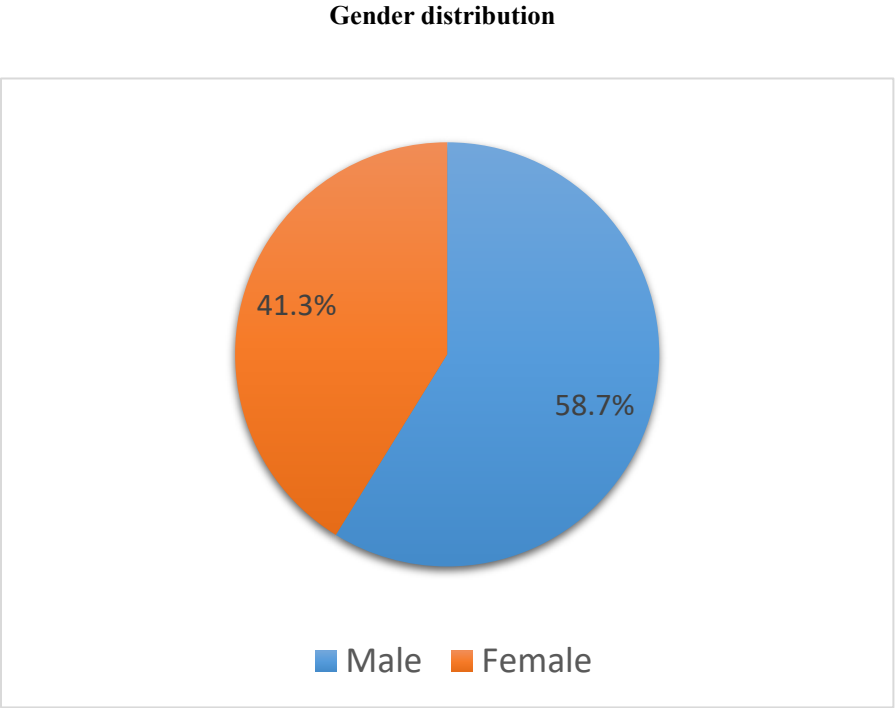

Figure 1 Gender distribution

Table 1: Demographic profile of patients

Demographic profile		N	%
Socioeconomic status	Lower background	31	22.5%
	Middle class	77	55.8%
	Upper class	30	21.7%
Education	Educated	73	52.9%
	Uneducated	65	47.1%
Occupation	Employed	71	51.4%
	Unemployed	67	48.6%
Residence status	Urban	77	55.8%
	Rural	61	44.2%

Table 2: Mediastinal Lymphoma on CT and histopathology

Mediastinal Lymphoma on CT and histopathology		N	%
Mediastinal lymphoma on CT	Positive	67	48.6%
	Negative	71	51.4%
Mediastinal lymphoma on histopathology	Positive	77	55.8%
	Negative	61	44.2%

Table 3: Diagnostic accuracy of CT in detecting mediastinal lymphoma

		Mediastinal lymphoma on Histopathology		Total
		Positive	Negative	
Mediastinal lymphoma on CT	Positive	60	7	67
		77.9%	11.5%	48.6%
	Negative	17	54	71
		22.1%	88.5%	51.4%
Total		77	61	138
		100.0%	100.0%	100.0%

Sensitivity: 77.92%, Specificity: 88.52%, Positive predictive value: 89.55%, Negative predictive value: 76.06%, Diagnostic accuracy: 82.61%

Table 4: Stratification of diagnostic accuracy with age

Age groups	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
18 to 35	72.73%	87.10%	85.71%	75.00%	79.69%
36 to 50	81.48%	87.50%	91.67%	73.68%	83.72%
51 to 65	81.25%	92.31%	92.86%	80.00%	86.21%

Table 5: Stratification of diagnostic accuracy with gender

Gender	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
Male	79.17%	90.63%	92.68%	74.36%	83.75%
|Female	75%	85.71%	84%	77.42%	80.36%

Table 6: Stratification of diagnostic accuracy with socioeconomic status

SES	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
Lower background	76.5%	92.86%	92.86%	76.47%	83.87%
Middle class	79.55%	87.50%	89.74%	75.68%	82.89%
Upper class	73.33%	85.71%	84.62%	75.00%	79.31%

Table 7: Stratification of diagnostic accuracy with education

Education status	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
Educated	73.81%	93.10%	93.94%	71.05%	81.69%
Uneducated	82.35%	83.87%	84.85%	81.25%	83.08%

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Table 8: Stratification of diagnostic accuracy with employment status

Employment status	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
Employed	73.68%	90.63%	90.32%	74.36%	81.43%
Unemployed	81.58%	85.71%	88.57%	77.42%	83.33%

Table 9: Stratification of diagnostic accuracy with residence

Residence	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
Urban	82.93%	86.11%	87.18%	81.58%	84.42%
Rural	71.43%	91.67%	92.59%	68.75%	79.66%

Table 10: Stratification of diagnostic accuracy with BMI

BMI (kg/m^2)	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
18 to 24.9	81.82%	89.66%	90.00%	81.25%	85.48%
> 24.9	74.42%	87.10%	88.89%	71.05%	79.73%

DISCUSSION:

The investigation encompassed 138 patients. Diagnostic performance metrics showed an accuracy of 82.61% with sensitivity of 77.92%, and specificity of 88.52%. These findings are herein contextualized within the framework of prior studies to elucidate CT's diagnostic utility.

Comparatively Rashid et al. assessed CT in 366 patients presenting with neck and mediastinal lymphoma over a six-month period, they reported a diagnostic accuracy of 87.4% along with sensitivity of 75% and specificity 89.9%.[10] The sensitivity in our study (77.92%) approximates with their study indicating comparable efficacy in identifying the true positives. However, the specificity 88.52% was marginally lower than their 89.9% which reflects a higher false-positive rate which can be due to methodological or cohort variations.

Pandey et al. carried out a study on 60 patients with mediastinal masses including lymphomas multidetector CT (MDCT), their diagnostic accuracy as 93%, sensitivity 94% and specificity was 90%.[11] The superior accuracy and sensitivity relative to our findings suggest that MDCT's enhanced diagnostic capacity is likely due to its advanced imaging proficiencies. The specificity of our study (88.52%) approaches their 90% yet the PPV (89.55%) and NPV (76.06%) of our study fall short of their 94% and 90% respectively. This difference may reflect the broader diagnostic scope of Pandey et al. incorporating various mediastinal pathologies in their study.

Broccoli et al. in their investigation examined PET/CT-guided biopsies in about 96 procedures for suspected lymphoma reporting a diagnostic yield of 87.5%, with sensitivity 96% and specificity 100%, they reported PPV 100% and NPV 75%.[12] Although direct comparison is perplexed by PET/CT's hybrid nature, our study's sensitivity (77.92%) and specificity (88.52%) are notably lower than their 96% and 100% respectively. The PPV (89.55%) similarly in our study was a little lower their 100% while the NPV (76.06%) in our study resonates closely with their 75%. This similarity in NPV underscores a shared limitation in excluding lymphoma while PET/CT's superior sensitivity and specificity is likely derived from its metabolic imaging component.

Hashemi et al. compared ultrasonography with CT in 34 patients with anterior mediastinal neoplasms including lymphomas they found the CT sensitivity 84.6% and specificity 90.5%, PPV 84.6% and NPV 90.5%. [13] Our study's sensitivity (77.92%) was lower though our specificity (88.52%) is comparable which indicates a consistent performance in ruling out disease. The higher PPV in our study (89.55%) versus their 84.6% contrasted with a lower NPV (76.06% versus 90.5%) may reflect the influence of a larger sample size of our cohort. Our study's accuracy of 82.61% is robust and it's a promising modality for detecting mediastinal lymphoma. We advise future researches should compare CT with other diagnostic modalities as mentioned in aforementioned discussion.

CONCLUSION:

We conclude that CT is an efficient and effective modality for the detection of mediastinal lymphoma, with a diagnostic accuracy of 82.61%, sensitivity of 77.92%, and specificity of 88.52%, validated against histopathology.

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

AUTHOR CONTRIBUTION

Author	Contribution
Adnan Ahmed	Substantial Contribution to study design, analysis, interpretation of Data Has given Final Approval of the version to be published
Ayesha Amjad*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Amjad Ali	Assistance in Data Interpretation
Ghazala Wahid	Assistance in Data Interpretation
Rabeea Ihtesham	Assistance in Data Interpretation
Munazza Kainat Shuja	Assistance in Data Interpretation
Shandana Khan	Literature Review
Muneeba Javed	Literature Review
Mahrukh Abdullah	Literature Review

REFERENCE:

Medifocus guidebook on Non Hodgkin's Lymphoma. USA: Elliot Jacob. Create Space Independent Publishing Platform; 2011.
Fisher SG, Fisher RI. The epidemiology of non-Hodgkin's lymphoma. Oncogene. 2004;23(38):6524-34..
Oberlin O, Faranoush M. Pediatric Non Hodgkin's Lymphomas. Iranian J Blood Cancer. 2010;3:107-2.
Watanabe T, Shimomura H, Mutoh T, Saito R, Goto R, Yamada T, et al. Positron emission tomography/computed tomography as a clinical diagnostic tool for anterior mediastinal tumors. Surgery Today. 2019;49:143-9.
Byrd CT, Trope WL, Bhandari P, Konsker HB, Moradi F, Lui NS, et al. Positron emission tomography/computed tomography differentiates resectable thymoma from anterior mediastinal lymphoma. J Thorac Cardiovasc Surg. 2023;165(1):371-81.
Ghigna MR, de Montpreville VT. Mediastinal tumours and pseudo-tumours: a comprehensive review with emphasis on multidisciplinary approach. Eur Respir Rev. 2021.
Carter BW, Tomiyama N, Bhora FY, De Christenson ML, Nakajima J, Boiselle PM, et al. A modern definition of mediastinal compartments. J Thorac Oncol. 2014;9(9):S97-101.
Taka M, Kobayashi S, Mizutomi K, Inoue D, Takamatsu S, Gabata T, et al. Diagnostic approach for mediastinal masses with radiopathological correlation. Eur J Radiol. 2023;162:110767.
Al-Ansari RY, Aljarah NM, Alofi GM, Shaigah FA, Al-Qahtany FH, Jebakumar AZ, et al. Incidence of Lymphoma Among Adult Patients in the Eastern Province of Saudi Arabia–A Single-center Study. J Appl Hematol. 2023;14(3):194-200
Rashid S, Darira J, Iqbal J, Hamid K, Usman R, Lufti IA. Diagnostic accuracy of computed tomography (CT) in patients with neck and mediastinal lymphoma and correlate with gold standard histopathology results. Ann Punjab Med Coll. 2016;10(4):237-41.
Pandey S, Jaipal U, Mannan N, Yadav R. Diagnostic accuracy of multidetector computed tomography scan in mediastinal masses assuming histopathological findings as gold standard. Pol J Radiol. 2018;83:e234-e242.
Broccoli A, Nanni C, Cappelli A, et al. Diagnostic accuracy of positron emission tomography/computed tomography-driven biopsy for the diagnosis of lymphoma. Eur J Nucl Med Mol Imaging. 2020;47(13):3058-3065.
Hashemi A, et al. Accuracy of ultrasonography vs. CT in anterior mediastinal neoplasms. Iran J Pediatr Hematol Oncol. 2012;2(1):6-10.

