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A CROSS-SECTIONAL STUDY TO ASSESS THE ROLE OF MULTI-DETECTOR COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF MEDIASTINAL MASSES ASSUMING HISTOPATHOLOGICAL FINDINGS AS GOLD STANDARD

Radio-Diagnosis

Dr Apurva* Junior Resident Doctor Department Of Radiodiagnosis, SMS Medical College, Jaipur, India *Corresponding Author

Dr Chaturbhuj Prasad Swarnkar Senior Professor Department Of Radiodiagnosis, SMS Medical College, Jaipur, India

Dr Naima Mannan Senior Professor Department Of Radiodiagnosis, SMS Medical College, Jaipur, India

ABSTRACT

Background: Mediastinal masses are a diverse group of conditions that pose diagnostic challenges. This study evaluates the diagnostic accuracy of Multi-Detector Computed Tomography (MDCT) in assessing mediastinal masses. **Materials And Methods:** This prospective observational study was conducted at the Department of Radiodiagnosis, SMS Medical College and Hospital, Jaipur, Rajasthan. Following institutional approval, data were collected from eligible patients referred for MDCT assessment. Inclusion criteria were patients over 18 years who provided informed consent. A total of 54 patients were enrolled. Data collection utilized a pre-designed proforma, and MDCT was performed using 128-slice or 256-slice GE machines. Statistical analysis involved percentages, means, and standard deviations. **Results:** The study analyzed 54 patients (average age 57.4 ± 15.67 years; 53.7% males, 46.3% females). The predominant symptoms included chest pain (50%), weight loss (44.4%), and fever (42.6%). Most masses were located in the prevascular (42.6%) and visceral compartments (38.9%). The most common diagnoses were tubercular lymphadenopathy (14.81%) and lymphoma (12.96%), while 35 benign and 19 malignant lesions were identified. Nine lesions (16.3%) showed evidence of invasion. CT demonstrated remarkable diagnostic accuracy, with 100% sensitivity and specificity for conditions such as bronchogenic cysts, germ cell tumors, thymic carcinoma, and metastatic lymph nodes. **Conclusion:** Multidetector computed tomography (MDCT) is an invaluable tool for assessing mediastinal lesions, offering detailed insights into the extent, tissue composition, enhancement patterns, and potential invasion of mediastinal structures and blood vessels.

KEYWORDS

Mediastinal masses, Multi-Detector Computed Tomography, diagnostic accuracy, benign lesions, malignant lesions, chest imaging.

INTRODUCTION:

The mediastinum is a central compartment in the thoracic cavity, separating the lungs and housing vital structures such as the esophagus, heart, thymus, trachea, and major blood vessels, including the aorta.[1] It is divided into three regions: the anterior mediastinum (containing thymoma, teratoma, and lymphoma), the middle mediastinum (housing the heart and trachea), and the posterior mediastinum (containing the esophagus and descending aorta). Mediastinal masses account for about 3% of chest tumors[2], with nearly 40% of individuals being asymptomatic and often diagnosed incidentally during unrelated chest X-rays. Symptoms typically arise from the compression of nearby structures.[3] Computed tomography (CT) has become the primary modality for evaluating mediastinal masses, offering superior spatial resolution and the ability to differentiate tissue densities.[4-6] Unlike chest radiographs, CT provides detailed cross-sectional images, facilitating the characterization of lesions and assessment of surrounding structures. It is also valuable for pre-operative planning and utilizes advanced post-processing techniques for enhanced visualization. Overall, CT is highly effective for diagnosing various mediastinal pathologies, clearly delineating abnormalities from normal tissues.[7,8] The aim of this study is to evaluate the diagnostic accuracy of Multi-Detector Computed Tomography (MDCT) in identifying mediastinal mass lesions compared to histopathology results. The primary objective is to assess the accuracy of MDCT in diagnosing mediastinal masses, while the secondary objective is to differentiate between benign and malignant lesions based on MDCT findings and their correlation with histopathology examinations.

MATERIALS AND METHODS:

This prospective observational study, designed as a cross-sectional analysis, was conducted in the Department of Radiodiagnosis at SMS Medical College and Hospital, Jaipur, Rajasthan. Data collection began after institutional approval and continued until the required sample size was achieved or until September 2023. The study population included patients referred for Multi-Detector Computed Tomography (MDCT) assessment of mediastinal masses who met the inclusion and exclusion criteria. Patients above 18 years who provided informed consent were included, while those with prior treatment for mediastinal masses, abnormal renal function, contrast sensitivity, or who refused consent were excluded. A total of 54 eligible patients were selected using a sampling technique based on inclusion and exclusion criteria. Data were collected using a pre-designed proforma, and MDCT was performed using a 128-slice GE REVOLUTION EVO or a 256-slice GE REVOLUTION ES machine. The sample size was calculated to be 54, based on an assumed 83% prevalence of mediastinal masses on MDCT, with a 10% allowable error at a 95% confidence interval. Following patient consent, a detailed history, general examination, and MDCT with intravenous contrast were performed. Radiologists interpreted the CT scans, and histopathological examinations were conducted. Data were analyzed using percentages, proportions, means, and standard deviations.

RESULTS:

In our study, we analyzed 54 patients with an average age of 57.4 ± 15.67 years, including 53.7% males and 46.3% females. The most prevalent symptom was chest pain or discomfort, reported by 50% of patients, followed by weight loss (44.4%) and fever (42.6%). The majority of mediastinal masses were located in the prevascular compartment (42.6%), followed by the visceral compartment (38.9%), with the paravertebral compartment being the least common (18.5%). Patients were classified into benign and malignant lesions based on histological and computed tomography (CT) findings. The most common diagnoses included tubercular lymphadenopathy in 14.81% of cases (8 patients) and lymphoma in 12.96% (7 patients). Thymomas and neurogenic tumors each accounted for 9.25% (5 patients each), while metastatic lymph nodes and esophageal carcinoma represented 7.4% (4 patients each). Germ cell tumors and thymic carcinoma were noted in 5.55% (3 patients each). Less common diagnoses, such as bronchogenic cysts, multinodular goiters, reactive lymph nodes, sarcoidosis, and thymic cysts, occurred in 2 to 3 cases, making up 3.7% to 5.55% of the total. Rare conditions like thyroid carcinoma, mediastinal abscess, pyogenic spondylodiscitis, and Potts spine were diagnosed in only 1 to 2 patients each, accounting for 1.85% to 3.7%. This illustrates the variety of conditions identified through CT imaging, particularly highlighting infectious and neoplastic diseases within this patient group. Histological analysis identified 35 benign lesions, matching the 35 benign cases reported by CT. Both histology and CT indicated 19 malignant lesions. Among the 54 patients, 9 lesions showed evidence of invasion, representing 16.3% of the total, while the remaining 45 lesions (83.3%) were non-invasive, indicating that most lesions in the study were non-invasive. CT scans demonstrate excellent diagnostic performance across most mediastinal mass types, with metrics frequently reaching 100%, suggesting a high reliability for positive and negative findings in these cases. For example, masses such as bronchogenic cysts, germ cell tumors, thymic carcinoma, and thymoma all exhibit 100% across sensitivity, specificity, PPV, NPV, and DA, indicating that CT scans consistently detect these masses

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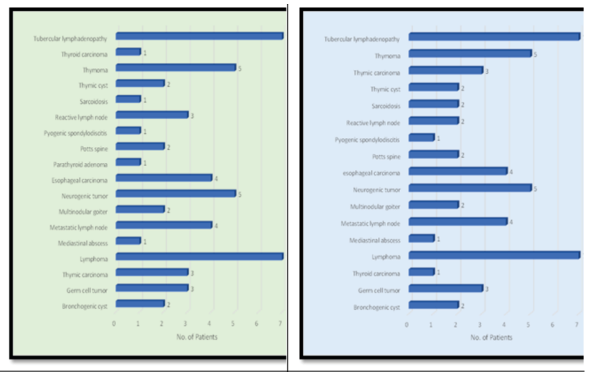
accurately.However, the diagnostic accuracy for some masses is less definitive. For metastatic lymph nodes, sensitivity is notably lower at 50%, with specificity at 96%, indicating that while a positive result is likely correct, there is a risk of false negatives. Similarly, for reactive lymph nodes, sensitivity is 33.3%, showing a limited ability to detect this condition accurately, although specificity remains high at 98.04%. Parathyroid adenomas lack sensitivity and DA metrics, with specificity at 98.15%, reflecting limited detection capability. Tubercular lymphadenopathy and sarcoidosis also have moderate sensitivity (62.5% and 50%, respectively) but high specificity, implying that CT scans may not always detect these masses accurately yet still provide reliable negative results. Overall, this analysis demonstrates the CT scan's robustness in diagnosing certain mediastinal masses but highlights limitations for specific conditions, which may benefit from complementary diagnostic methods. The table 1 also reveals instances where CT scan results diverged from histological findings, pointing to specific types of misdiagnoses. Like, in cases of metastatic lymph nodes, the CT scan identified four cases, but histology confirmed only two as metastatic; the other two cases were actually tubercular lymphadenopathy. In another instance, a case diagnosed by CT as parathyroid adenoma was later identified through histology as reactive lymph node. Additionally, three cases identified by CT as reactive lymph nodes showed mixed results on histology; only one was genuinely reactive, while the others were reclassified as one case of sarcoidosis and one of lymphadenopathy. In cases of lymphadenopathy, seven were identified by CT, but histology showed that only two were metastatic lymph nodes; the remaining five were actually tubercular lymphadenopathy. This misalignment between CT scan and histological findings highlights challenges in accurately distinguishing specific types of lymphadenopathies and related masses with CT alone, underscoring the potential need for histological confirmation in complex cases.



CT report	Histological report

Fig:1 Distribution of the mediastinal masses

Table.1 Diagnostic Accuracy of CT scan in diagnosing mediastinal Mass

Mediastinal Mass	Sensitivity %	Specificity %	PPV %	NPV %	DA
Bronchogenic cyst	100	100	100	100	100
Germ cell tumor	100	100	100	100	100
Thymic Carcinoma	100	100	100	100	100
Thyroid carcinoma	100	100	100	100	100
Mediastinal abscess	100	100	100	100	100
Metastatic lymph node	50q	96	50	96	92.6
Multinodular goiter	100	100	100	100	100
Neurogenic tumor	100	100	100	100	100
Lymphoma	100	100	100	100	100
Esophageal carcinoma	100	100	100	100	100
Parathyroid adenoma	-	98.15	0	100	-
Potts spine	100	100	100	100	100
Pyogenic spondylodiscitis	100	100	100	100	100
Reactive lymph node	33.3	98.04	50	96.15	94.44
Sarcoidosis	50	100	100	98.11	98.15
Thymic cyst	100	100	100	100	100
Thymoma	100	100	100	100	100
Tubercular lymphadenopathy	62.5	95.6	71.4	93.6	90

DISCUSSION:

Mediastinum is a complex anatomical segment in the chest having an intricate anatomy making it prone to various pathologies ranging from benign cysts to aggressive malignancies. MDCT is employed to diagnose various causes of mediastinal widening and often correct diagnosis is obtained using it alone. It also helps to delineate the extent and nature of lesions and their relation with adjacent organs.[9,10]. Accuracy for certain masses is less consistent. For instance, metastatic lymph nodes have a sensitivity of 50% and a specificity of 96%, suggesting a high chance of correct positive findings but a potential for false negatives. Similarly, reactive lymph nodes have a sensitivity of 33.3%, highlighting limited detection capability, though specificity remains high at 98.04%. Parathyroid adenomas lack sensitivity and DA data, with a specificity of 98.15%, indicating some diagnostic limitations. Tubercular lymphadenopathy and sarcoidosis show moderate sensitivity (62.5% and 50%, respectively) but maintain high specificity, suggesting that while negative results are reliable, these masses may sometimes go undetected.

The data also reveals instances where CT findings differed from histological results, indicating specific misdiagnoses. For example, of four cases identified as metastatic lymph nodes by CT, histology confirmed only two, while the others were actually tubercular lymphadenopathy. In another case, CT identified a parathyroid adenoma, which histology later confirmed as a reactive lymph node. Additionally, three cases labelled as reactive lymph nodes on CT were reclassified by histology: only one was truly reactive, while the others were identified as sarcoidosis and lymphadenopathy.

Supporting our findings, previous studies reported similar results: **de Campos et al.**[11] **(2002)** confirmed 100% sensitivity and specificity for bronchogenic cysts, and **Motohiro et al.** [12]**(2007)** noted high accuracy for germ cell tumors. **Giraud et al.**[13]**(2002**) found 100% sensitivity and 95% specificity for invasive thymomas. Other studies corroborated high accuracy for various conditions, including mediastinal abscesses, metastatic lymph nodes, neurogenic tumors, and thyroid carcinoma. Additionally, **Pandey et al.**[10] **(2018)** reported MDCT sensitivity of 94% and specificity of 90%, while Sreenivasan et al. (2021) found 100% sensitivity and 92.6% specificity. **Pulasani et al.**[14] **(2015)** achieved approximately 92% accuracy for evaluating mediastinal masses using MDCT with histopathological correlation. Overall, our findings align with existing literature, highlighting the reliability of CT imaging in diagnosing mediastinal masses. In our study, Histological analysis identified 35 benign lesions, consistent with CT findings, while both methods revealed 19 malignant lesions. Out of 54 patients, 9 lesions (16.3%) showed invasion, indicating that most lesions (83.3%) were non-invasive. **Sreenivasan et al.** [55]**(2021**) also found 14.81% of lesions invasive, reinforcing the non-invasive nature of most findings. **Pande et al.**[10] **(2018)** reported 34 benign lesions histologically and 35 via CT, reflecting strong diagnostic correlation, with 20 malignant lesions identified histologically and 19 by CT. Key characteristics differentiate benign from malignant lesions on CT scans: benign lesions typically have well-defined, smooth margins and homogeneous density, while malignant lesions present irregular margins, heterogeneous density, and rapid growth. Malignant tumors may invade surrounding tissues, metastasize, and show abnormal lymphadenopathy. Comprehensive evaluation aids in distinguishing these conditions, though histopathological confirmation is often necessary for accurate diagnosis.

CONCLUSION:

MDCT proves invaluable for evaluating mediastinal masses, offering precise insights into their distribution and relationship with adjacent structures, and effectively distinguishing between malignant and benign lesions. Histopathology, used as the gold standard, revealed a diverse array of diagnoses, with tubercular lymphadenopathy and lymphoma being the most common. MDCT proved particularly effective in identifying conditions such as bronchogenic cysts, thymoma, thymic cysts, and neurogenic tumors, all of which displayed perfect diagnostic accuracy. MDCT overall showed strong diagnostic performance, with high specificity and negative predictive value across most conditions. This study underscores the importance of MDCT as a key imaging modality for accurate diagnosis and management of mediastinal pathology.

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