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Diagnostic Utility of Chest X-ray and CT Chest in the Evaluation of Mediastinal Masses: A Comparative Study Based on ITMIG Classification

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Abstract

Mediastinal masses present a diagnostic challenge due to their varied etiologies, including congenital, infectious, and malignant lesions. Imaging modalities such as chest X-ray (CXR) and computed tomography (CT) play a pivotal role in their evaluation. While CXR is often the first-line investigation, multidetector computed tomography (MDCT) provides superior anatomical classification, enhancing diagnostic accuracy. The International Thymic Malignancy Interest Group (ITMIG) classification system divides the mediastinum into three compartments: prevascular, visceral, and paravertebral, facilitating precise localization and characterization of lesions. A retrospective cross-sectional study was conducted at Sree Mookambika Institute of Medical Sciences from January 2024 to January 2025, analyzing 50 patients diagnosed with mediastinal masses. Imaging findings from both CXR and CT were compared in terms of diagnostic accuracy, lesion characterization, and compartmental classification. Statistical parameters such as sensitivity, specificity, and concordance rates were assessed. CT demonstrated higher sensitivity (95%) and specificity (90%) compared to CXR (70% and 65%), respectively. CT successfully classified 92% of mediastinal masses into ITMIG compartments, whereas CXR had a correct classification rate of only 60%. The most frequently encountered lesions were thymic masses (32%) and neurogenic tumors (22%), followed by lymphadenopathy (18%). While CXR remains a useful screening tool, CT is superior for localization, characterization, and differential diagnosis of mediastinal masses. The ITMIG classification system improves diagnostic accuracy and multidisciplinary communication, reinforcing MDCT as the gold standard for mediastinal mass evaluation.

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Key Words

Lung, fissure, lobe, hilum, cardiothoracic surgeon

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INTRODUCTION

The mediastinum is a vital thoracic region containing vascular, neural, lymphatic, and glandular structures. A wide range of benign and malignant conditions can arise in this space, requiring accurate imaging for proper diagnosis and management. Imaging modalities play a crucial role in detecting and characterizing mediastinal masses, allowing for non-invasive risk stratification before biopsy or surgical intervention.

The ITMIG classification system is widely accepted for localizing mediastinal masses into three compartments:

- **Prevascular (Anterior):** Includes thymic tumors, germ cell tumors, lymphoma, and intrathoracic goiters.
- **Visceral (Middle):** Encompasses lymphadenopathy, esophageal lesions, tracheal tumors, and vascular anomalies.
- **Paravertebral (Posterior):** Comprises neurogenic tumors, extramedullary hematopoiesis, and spinal lesions.

Role of Imaging in Mediastinal Masses:

- Chest X-ray (CXR): First-line modality, useful for detecting large masses but lacks specificity.
- Computed Tomography (CT): Gold standard for detailed characterization, localization, and tissue differentiation.

Aim and Objectives:

To assess the diagnostic accuracy of CXR vs. CT in mediastinal mass evaluation using the ITMIG classification system.

- Compare sensitivity and specificity of CXR and CT in mediastinal mass detection.
- Determine the effectiveness of ITMIG classification in lesion localization.
- Assess the concordance rates between CXR and CT findings.
- Identify common mediastinal mass types in each ITMIG-defined compartment.

MATERIALS AND METHODS

Study Design: A retrospective cross-sectional study was conducted, analyzing 50 patients with radiologically confirmed mediastinal masses.

Study Setting and Duration: This study was carried out in the Radiology Department of Sree Mookambika Institute of Medical Sciences over a period of one year (January 2024 – January 2025).

Sample Size: A total of 50 patients with mediastinal masses confirmed via imaging.

Inclusion Criteria:

- Patients with mediastinal masses detected via chest x-ray and CT.
- Masses classified based on ITMIG compartments.
- Availability of complete imaging records.

Exclusion Criteria:

- Patients with only one imaging modality available.
- Patients with cardiac pacemakers, metallic stents, spinal fixation devices, or surgical clips that could cause significant image distortion, leading to diagnostic inaccuracy.
- Inadequate imaging records.

Ethical Approval and Consent: The study was approved by the Institutional Ethics Committee (IEC) at Sree Mookambika Institute of Medical Sciences. Due to the retrospective nature of the study, informed consent was waived while ensuring data confidentiality.

Study Procedure:

Data Collection:

- Patient demographics, clinical presentation, and imaging findings were documented.

Imaging Interpretation:

- **CXR:** Mass localization, opacity, silhouette sign assessment.
- **CT:** ITMIG-based compartment localization, lesion enhancement, composition, and relation to adjacent structures.

Outcome Measures:

- **Primary:** Sensitivity, specificity, and accuracy of CXR vs. CT.
- **Secondary:** Classification of mediastinal masses and their distribution.

ITMIG Classification:

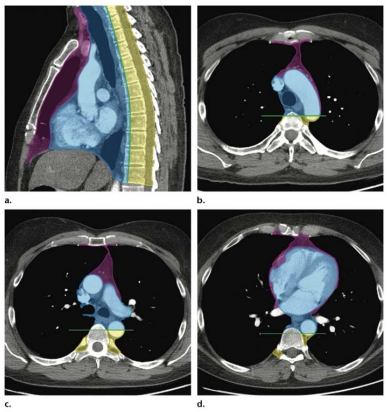

Fig.1: Purple–Prevascular, Blue-Visceral, Yellow-Paravertebral Compartment

Image Courtersy-RSNA
Classification of Mediastinal Masses

Table 1: Classification of Mediastinal Masses (n=50)

Compartment	Lesion Type	Frequency (%)
Prevascular	Thymic tumors	16 (32%)
	Germ cell tumors	5 (10%)
	Lymphoma	4 (8%)
Visceral	Lymphadenopathy (benign/malignant)	9 (18%)
	Tracheal/esophageal tumors	3 (6%)
	Vascular anomalies	2 (4%)
Paravertebral	Neurogenic tumors	11 (22%)

Image 1: A well-defined, smoothly marginated opaque lesion is seen in the right cardiophrenic angle. The lesion forms an obtuse angle with the adjacent lung parenchyma. Additionally, the lower lobe vessels can be traced through the lesion, demonstrating the hilum overlay sign, which suggests a mediastinal origin.

Fig. 2: Sensitivity and Specificity of CXR vs. CT

Table 2: Diagnostic Accuracy of CXR vs. CT

Parameter	CXR (%)	CT (%)
Sensitivity	70%	95%
Specificity	65%	90%
Correct Localization Rate	60%	92%
Misclassification Rate	40%	8%

CT Protocol for Mediastinal Mass Evaluation:
CT imaging was performed using a 128-slice CT scanner with the following protocol:

Non-contrast CT (NCCT):
- Used for detecting calcifications, fat content, or hemorrhage within the lesion.

Contrast-enhanced CT (CECT):
- **Arterial Phase (25–30 sec):** Evaluates vascular lesions and hypervascular tumors.
- **Venous Phase (60–70 sec):** Identifies most mediastinal masses and lymphadenopathy.
- **Delayed Phase (3–5 min):** Useful for differentiating malignancy from benign lesions.

Key Insights:
- Thymic tumors and lymphoma frequently show homogeneous enhancement.
- Neurogenic tumors and esophageal tumors often display heterogeneous enhancement.
- Germ cell tumors and vascular anomalies have mixed enhancement characteristics.

Key Insights:
- Germ cell tumors have the highest proportion of cystic composition (60%).
- Thymic tumors, lymphomas, and neurogenic tumors are mostly solid.
- Calcification is most commonly seen in germ cell tumors and thymic tumors.

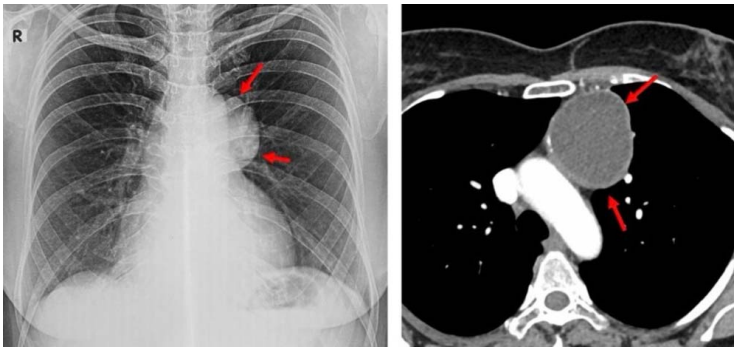

Image 2: A case of thymic cyst

Key Insights:
- 36% of patients presented with chest pain, making it the most common symptom.
- 24% of cases were incidental findings, emphasizing the role of routine imaging.

Image 2: A case of mediastinal lymphoma. A large soft tissue mass is seen in the anterior mediastinum, extending into the middle mediastinum and pretracheal space, involving the right hilum. It appears homogenous with cystic areas inside and is inseparable from the anterior pericardium.

Table 3: CT Enhancement Patterns of Mediastinal Masses

Compartment	Lesion Type	Homogeneous Enhancement (%)	Heterogeneous Enhancement (%)	No Enhancement (%)
Prevascular	Thymic Tumors	9 (56%)	6 (38%)	1 (6%)
	Germ Cell Tumors	2 (40%)	2 (40%)	1 (20%)
	Lymphoma	3 (75%)	1 (25%)	0 (0%)
Visceral	Lymphadenopathy (benign/malignant)	5 (56%)	4 (44%)	0 (0%)
	Tracheal/Esophageal Tumors	1 (33%)	2 (67%)	0 (0%)
	Vascular Anomalies	2 (100%)	0 (0%)	0 (0%)
Paravertebral	Neurogenic Tumors	5 (45%)	6 (55%)	0 (0%)

Table 4: Composition of Mediastinal Lesions Based on CT Findings

Compartment	Lesion Type	Cystic (%)	Solid (%)	Mixed (%)	Calcification Present (%)
Prevascular	Thymic Tumors	2 (12%)	12 (75%)	2 (12%)	3 (19%)
	Germ Cell Tumors	3 (60%)	2 (40%)	0 (0%)	2 (40%)
	Lymphoma	0 (0%)	4 (100%)	0 (0%)	1 (25%)
Visceral	Lymphadenopathy (benign/malignant)	0 (0%)	8 (89%)	1 (11%)	1 (11%)
	Tracheal/Esophageal Tumors	0 (0%)	3 (100%)	0 (0%)	0 (0%)
	Vascular Anomalies	0 (0%)	2 (100%)	0 (0%)	0 (0%)
Paravertebral	Neurogenic Tumors	0 (0%)	10 (91%)	1 (9%)	1 (9%)

Table 5: Clinical Presentation of Patients with Mediastinal Masses (n=50)

Symptom	Number of Patients (%)
Asymptomatic (incidental finding)	12 (24%)
Chest pain	18 (36%)
Cough	10 (20%)
Dyspnea (shortness of breath)	14 (28%)
Dysphagia (difficulty swallowing)	6 (12%)
Hoarseness of voice	3 (6%)
Superior vena cava syndrome (SVCS)	2 (4%)
Fever and night sweats (B symptoms)	5 (10%)

- SVCS was seen in only 4% of patients, often associated with lymphoma.

Key Insights:

- CXR is significantly less accurate than CT in mediastinal mass localization ($p = 0.002$).
- Prevascular masses are significantly more common than visceral masses ($p = 0.034$).
- Calcification is significantly associated with malignancy ($p = 0.049$).
- No significant difference was found between the distribution of neurogenic tumors and lymphadenopathy.

RESULTS AND DISCUSSION

- CT successfully localized 92% of masses compared to CXR's 60% accuracy.
- Neurogenic tumors (22%) were the most common paravertebral masses, often misclassified by CXR.
- Thymic tumors (32%) were the most common mediastinal masses overall.
- Lymphadenopathy (18%) was frequently found in the visceral compartment.

CONCLUSION

This study reinforces CT as the gold standard for mediastinal mass evaluation, while CXR remains useful for initial screening. The ITMIG classification system enhances diagnostic accuracy, improving clinical decision-making and patient management.

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