**Original Article**

**DOI:**

# Multidetector Computed Tomography (MDCT) in the Diagnosis of Mediastinal Mass with Cytopathological Correlation

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**Abstract:**

**Background:** Mediastinal masses comprise a diverse group of thoracic lesions and remain a diagnostic challenge because of their complex anatomical location. The reported incidence of mediastinal masses has increased over recent decades, and accurate imaging plays a crucial role in evaluation. Multidetector computed tomography (MDCT) is considered the investigation of choice for assessment of mediastinal lesions.

**Objective:** To evaluate the diagnostic usefulness of MDCT in mediastinal masses and correlate imaging findings with cytopathology, including assessment of sensitivity, specificity, accuracy, positive predictive value (PPV), and negative predictive value (NPV).

**Methods:** This prospective cross-sectional study was conducted in the Department of Radiology and Imaging, Sylhet MAG Osmani Medical College Hospital, from September 2019 to August 2021. Ninety-six patients with suspected mediastinal mass underwent contrast-enhanced CT followed by cytopathological examination. Data were analyzed using SPSS version 25.

**Results:** The anterior mediastinum was the most common site (45.8%). Malignant lesions accounted for 60.4% and benign lesions for 39.6%. Lymphadenopathy was most frequent (42.7%), followed by thymoma, germ cell tumor, abscess (each 8.3%), esophageal lesions (7.3%), thyroid masses and neurogenic tumors (each 6.3%). For malignant masses, MDCT showed sensitivity 96.5%, specificity 89.5%, and accuracy 93.7%. For benign lesions, sensitivity was 89.5%, specificity 96.5%, and accuracy 93.7%.

**Conclusion:** MDCT is a highly sensitive, specific, and accurate modality for evaluating mediastinal masses, effectively determining lesion characteristics and reliably differentiating benign from malignant lesions.

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**Key words:** Mediastinal mass, Multidetector computed tomography (MDCT), Sensitivity, Specificity, Bangladesh.

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## Introduction:

The mediastinum is a complex anatomical region located centrally within the thoracic cavity, bounded by the thoracic inlet superiorly, diaphragm inferiorly, sternum anteriorly, spine posteriorly, and mediastinal pleura laterally.

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It is divided into anterior, middle, and posterior compartments, and this compartmental classification is essential because the differential diagnosis of mediastinal masses depends largely on their anatomical location[1]. Mediastinal masses comprise a heterogeneous group of lesions accounting for approximately 3% of thoracic tumors, with reports suggesting a rising incidence of malignant mediastinal tumors in recent decades[2]. These lesions may originate primarily within mediastinal structures or represent metastases from lung or extrathoracic malignancies[3,4]. Mediastinal

tumors can occur in all age groups, although some studies report higher frequency among young adults with male predominance[5]. Clinical manifestations vary widely from asymptomatic incidental findings to symptoms such as cough, dyspnea, and chest pain, with symptoms occurring more commonly in malignant lesions due to invasion or compression of adjacent structures[6]. Epidemiological data suggest that approximately 62% of mediastinal tumors are malignant while 38% are benign[7].

About half of mediastinal masses arise in the anterior compartment, including thymoma, teratoma, thyroid lesions, and lymphoma; middle mediastinal lesions are often congenital cysts or lymphadenopathies, whereas posterior mediastinal masses frequently consist of neurogenic tumors or paravertebral lesions[8]. Because of such variability, accurate imaging evaluation is essential before any invasive procedure for the tissue diagnosis. Conventional chest radiography may detect mediastinal abnormalities but is limited in sensitivity and in assessing lesion extent and anatomical relationships[9]. Computed tomography (CT) overcomes these limitations due to its high density resolution and tomographic capability, enabling precise assessment of lesion location, extent, morphology, and relationship with adjacent structures[10]. CT is also superior to radiography for evaluation of mediastinal lymph nodes and staging of disease[1].

Specific CT features such as attenuation, enhancement, calcification, and anatomical relationships may suggest a particular diagnosis[11]. Multidetector computed tomography (MDCT), with rapid acquisition and multiplanar reconstruction, further improves diagnostic capability. A previous study reported sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of MDCT for mediastinal masses as 94%, 90%, 94%, 90%, and 90%, respectively[12]. Magnetic resonance imaging can provide additional information for vascular, spinal, or neural involvement but is limited by poorer spatial resolution and inability to demonstrate calcification as well as CT[13].

Tissue diagnosis remains important for confirmation. CT-guided fine-needle aspiration cytology (FNAC) is considered a valuable minimally invasive technique for deep thoracic lesions because accurate needle placement can be achieved while avoiding vital structures[14]. Before FNAC, contrast enhanced MDCT scan can differentiate benign and malignant mediastinal tumor, thus we can avoid unwanted FNAC that will help not only the patient's cost but also avoid complications caused by such invasive procedure. Reported diagnostic sensitivity and specificity of FNAC for mediastinal lesions are approximately 88% and 82%[15], while other studies have shown sensitivity up to 94.9% and accuracy around 90%[16].

Despite these advances, variability persists in reported diagnostic accuracy of MDCT and in imaging characteristics distinguishing benign from malignant mediastinal lesions. Therefore, the present study aimed to evaluate the diagnostic usefulness of MDCT in mediastinal masses, characterize lesions based on MDCT findings and determine sensitivity, specificity, and accuracy of MDCT in diagnosis.

**Materials and Methods**

This prospective cross-sectional study was conducted in the Department of Radiology and Imaging, Sylhet MAG Osmani Medical College Hospital, Sylhet, in collaboration with the Department of Pathology, from September 2019 to August 2021. The study population comprised patients referred from the Departments of Internal Medicine, Respiratory Medicine, and General Surgery (both indoor and outdoor) with clinical suspicion of mediastinal mass lesions and radiographic evidence of mediastinal widening on chest X-ray. A non-probability convenient sampling technique was used. Patients with hypersensitivity to intravenous contrast agents, raised serum creatinine levels, and pregnant women were excluded from the study. Written informed consent was obtained from all participants after explaining the study objectives.

All patients underwent contrast-enhanced multidetector computed tomography (MDCT) using a 160-slice CT scanner (Aquilion 160, Toshiba, Japan). Both pre- and post-contrast scans were obtained in the supine position during breath-hold, and images were acquired in axial, coronal, and sagittal planes using soft

tissue and bone window settings. CT findings—including lesion location, size, margins, density, enhancement pattern, calcification, necrosis, and invasion—were interpreted by an experienced radiologist. Lesions were categorized as benign or malignant based on certain features. Malignancy was suggested by irregular margins, heterogeneous attenuation, necrosis, invasion, and lymphadenopathy. Benign lesions showed smooth well-defined margins, homogeneous attenuation, fat or cystic components, and no invasion. CT-guided fine-needle aspiration cytology (FNAC) or tru-cut biopsy was performed under aseptic precautions using appropriate needles based on lesion location. Cytopathological findings were categorized as benign or malignant and were used as the reference standard.

Data were collected using a structured questionnaire prepared through literature review and expert consultation. Statistical analysis was performed using SPSS version 25.0. Descriptive statistics were used to summarize demographic and imaging variables. Diagnostic performance of MDCT was assessed by calculating sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy. Ethical approval was obtained from the Institutional Ethical Committee of Sylhet MAG Osmani Medical College, and patient confidentiality was strictly maintained.

**Result**

A total of 96 patients were evaluated, with a mean age of 53.7 ± 12.6 years; 63.5% were male and 36.5% female. Presenting symptoms included dyspnea (26%), fever (17.7%), chest pain (15.6%), dysphagia (13.5%), cough (11.5%), superior vena cava syndrome (5.2%), and backache (4.2%) (Table I). On MDCT, lesions were located in the anterior (45.8%), middle (15.6%), posterior (18.8%), and 19.8% involved multiple mediastinal compartments (Table II).

Cytopathology identified malignant lesions in 58 cases (60.4%) and benign lesions in 38 cases (39.6%). Among benign lesions, attenuation patterns included heterogeneous (13.2%), homogeneous (47.4%), fat density (21%), and cystic density (18.4%), whereas malignant lesions showed heterogeneous (67.3%) and homogeneous (32.7%) attenuation. Calcification was observed in benign (26.3%) and malignant (22.5%) lesions ($p = 0.028$), while necrosis was present in benign (32%) and malignant (36%) lesions ($p = 0.559$) (Table III). Radiological invasion was noted in malignant lesions (32.7%) and absent in benign lesions (0%) ($p = 0.017$). MDCT demonstrated 56 true positives, 34 true negatives, 4 false positives, and 2 false negatives, yielding sensitivity 96.55%, specificity 89.47%, PPV 93.33%, NPV 94.44%, and accuracy 93.75%, with LR+ 9.17 and LR− 0.04 (Table IV).

**Table I: Demographic distribution and Presenting complaints of the study patients (n=96)**

| | Category | Frequency (%) |
|---|---|---|
| **Age** | 11-20 | 8 (8.3%) |
| | 21-30 | 10 (10.4%) |
| | 31-40 | 17 (17.7%) |
| | 41-50 | 14 (14.6%) |
| | 51-60 | 27 (28.1%) |
| | 61-70 | 12 (12.5%) |
| | 71-80 | 8 (8.3%) |
| | Mean ± SD | 53.7±12.6 |
| **Sex** | Male | 61 (63.5%) |
| | Female | 35 (36.5%) |
| **Presenting complaints** | Dyspnea | 25 (26%) |
| | Fever | 17 (17.7%) |
| | Chest pain | 15 (15.6%) |
| | Dysphagia | 13 (13.5%) |
| | Cough | 11 (11.5%) |
| | Superior vena cava syndrome | 5 (5.2%) |
| | Backache | 4 (4.2%) |
| | Weight loss | 2 (2.1%) |
| | Anorexia | 1 (1%) |
| | Asymptomatic | 1 (1%) |
| | Fatigue | 1 (1%) |
| | Haemoptysis | 1 (1%) |

**Table II: MDCT Characteristics of Mediastinal Mases of the study population (n=96)**

| | | Category | Frequency (%) |
|---|---|---|---|
| **Compartmental Distribution** | | Anterior Mediastinum | 44 (45.8%) |
| | | Middle Mediastinum | 15 (15.6%) |
| | | Posterior Mediastinum | 18 (18.8%) |
| | | Multiple Mediastinum | 19 (19.8%) |
| **Size of Lesion** | | <3cm | 18 (18.7%) |
| | | 3-5 cm | 57 (59.4%) |
| | | >5 cm | 21 (21.9%) |
| **MDCT enhancement Patterns** | | Heterogeneous enhancement | 53 (55.21%) |
| | | Homogeneous enhancement | 24 (25%) |
| | | Non enhancing lesions | 7 (7.29%) |
| | | Rim enhancement | 7 (7.29%) |
| | | Luminal enhancement | 5 (5.21%) |
| **MDCT Attenuation Pattern** | **Benign (38, 39.6%)** | Heterogeneous | 5 (13.2%) |
| | | Homogeneous | 18 (47.4%) |
| | | Fat density | 8 (21%) |
| | | Cystic density | 7 (18.4%) |
| | **Malignant (58, 60.4%)** | Heterogeneous | 39 (67.3%) |
| | | Homogeneous | 19 (32.7%) |
| | | Fat density | 0 (0%) |
| | | Cystic density | 0 (0%) |

**Table III: Distribution of study patients by calcification, necrosis & invasion in MDCT**

| Cytopathological Feature | Finding | Benign (n=38, %) | Malignant (n=58, %) | P value |
|---|---|---|---|---|
| **Calcification** | Present | 10 (26.3%) | 13 (22.5%) | 0.028* |
| | Absent | 28 (73.7%) | 45 (77.5%) | |
| **Necrosis** | Present | 12 (32%) | 21 (36%) | 0.559* |
| | Absent | 26 (68%) | 37 (64%) | |
| **Invasion** | Present | 0 (0%) | 19 (32.7%) | 0.017* |
| | Absent | 38 (100%) | 39 (67.3%) | |

*P value reached from McNemar's Test

**Table IV: Diagnostic performance of MDCT in comparison to cytopathology (n=96)**

| MDCT findings | Cytopathological findings | | Total |
|---|---|---|---|
| | Malignant | Benign | |
| Malignant | 56 (TP) | 4 (FP) | 60 |
| Benign | 2 (FN) | 34 (TN) | 36 |
| Total | 58 | 38 | 96 |
| **Diagnostic values** | **Values** | **95% CI** | |
| Sensitivity | 96.55 | 88.27% – 99.05% | |
| Specificity | 89.47 | 75.87% – 95.83% | |
| Positive Predictive Value (PPV) | 93.33 | 84.07% – 97.38% | |
| Negative Predictive Value (NPV) | 94.44 | 81.86% – 98.46% | |
| Accuracy | 93.75 | 87.03% – 97.10% | |
| Positive Likelihood Ratio (LR+) | 9.17 | — | |
| Negative Likelihood Ratio (LR−) | 0.04 | — | |

## Discussion:

This study assessed the diagnostic performance of MDCT in evaluating mediastinal masses and correlating imaging findings with cytopathology. The mean age of patients was 53.7 years with male predominance (63.5%), which is consistent with prior reports indicating male preponderance in mediastinal tumors[2,17]. Hattiholi et al. observed a similar male predominance with mean age 44.77 years[18], while Pulasani et al. reported peak incidence between 46–60 years[17]. Dyspnea was the most common presenting symptom in this study, followed by fever and chest pain. Comparable findings have been reported previously. Hattiholi et al. identified dyspnea and chest pain as predominant symptoms[18], whereas Vedaraju et al. reported cough and dyspnea as the most frequent complaints[19]. Such variation highlights the nonspecific clinical presentation of mediastinal lesions and reinforces reliance on imaging for diagnosis.

Anterior mediastinum was the most commonly involved compartment (45.8%) in the present study. This agrees with established literature indicating that approximately half of mediastinal masses occur in the anterior compartment[8], likely due to the presence of thymic, lymphatic, and germ cell structures in this region[8]. Similar distributions have been reported by Aroor et al. (42.86%) and Kaur et al. (38.3%)[2,20], as well as by Vedaraju et al., who documented anterior involvement in 63.3% of cases[19]. The predominance of anterior mediastinal lesions highlights the importance of compartment-based diagnostic approaches, as it significantly narrows the differential diagnosis and guides further evaluation[8].

Regarding imaging characteristics, heterogeneous attenuation predominated among malignant lesions, whereas benign

lesions more commonly showed homogeneous, fat, or cystic density patterns. This observation is consistent with earlier reports that CT features such as attenuation pattern, enhancement characteristics, and tissue composition can help differentiate lesion types and suggest specific diagnoses[11]. Malignant lesions tend to exhibit heterogeneity due to necrosis, hemorrhage, or irregular tumor architecture, while benign lesions are usually more uniform in composition[11]. Calcification was observed in both benign and malignant lesions without a marked difference, indicating its limited specificity[11]. In contrast, radiological invasion was identified only in malignant lesions, emphasizing invasion into adjacent structures as a key imaging feature suggestive of malignancy and an important factor in assessing disease extent and operability[12].

The diagnostic performance of MDCT in this study was high, with sensitivity 96.55%, specificity 89.47%, positive predictive value 93.33%, negative predictive value 94.44%, and overall accuracy 93.75%. These findings are comparable to previous research. Pandey et al. reported sensitivity 94%, specificity 90%, and accuracy 93% for MDCT in mediastinal masses[12]. The similarity between results supports the reproducibility and reliability of MDCT as a diagnostic modality.

FNAC served as the reference standard for confirmation. Prior studies have shown that CT-guided FNAC is a safe and effective technique with high diagnostic yield. Desai et al. reported diagnostic accuracy of 85.71%[15], while Perez et al. documented sensitivity 94.9% and accuracy 90.4%[16]. Choudhuri et al. further demonstrated that FNAC could provide precise diagnosis in 83.3% of mediastinal lesions and may reduce the need for invasive surgical procedures[21].

**Study Limitations**

This was a single-center study with a relatively small sample size, which may limit generalizability. Convenience sampling introduces potential selection bias. Cytopathology, rather than histopathology in all cases, was used as the reference standard. The cross-sectional design prevented follow-up assessment, and interobserver variability in MDCT interpretation was not evaluated.

**Conclusion:**

Contrast-enhanced multidetector computed tomography is a highly sensitive and accurate modality for evaluating mediastinal masses. It reliably characterizes lesion features and correlates well with cytopathological diagnosis, making it a valuable non-invasive tool for differentiating benign and malignant lesions and guiding clinical management.

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