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Anterior Mediastinal Tuberculoma Mimicking Thymoma in a 16-Year-Old Male: A Radiological Diagnostic Dilemma

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Abstract

An anterior mediastinal mass in the adolescent age group is a diagnostic dilemma, as the radiological characteristics of neoplastic, inflammatory, and infectious diseases may be alike. Although thymoma is an important consideration, it is uncommon in this age group, and thymic tuberculosis (TB) is a rare entity that can mimic a thymic neoplasm.

We present the case of a 16-year-old boy with a three-week history of intermittent low-grade fever, dry cough, loss of appetite, and loss of weight. No complaints of airway problems or clinically significant peripheral lymphadenopathy were noted on physical examination. Thoracic computed tomography (CT) acquisition with contrast revealed a large mass in the anterior mediastinum measuring 5.8 × 3.2 × 9.2 cm, which was heterogeneous, with non-enhancing areas within the mass and peripheral calcification. The initial radiological diagnosis was thymoma. The patient underwent multidisciplinary evaluation, following which surgical excision was performed. Histopathology showed epithelioid cell granulomas with multinucleated giant cells. Molecular studies of the tissue identified *Mycobacterium tuberculosis* that was not resistant to rifampicin, thus confirming the diagnosis of tuberculous involvement of the thymic region. The patient was treated with antitubercular drugs and showed clinical improvement following therapy, with resolution of fever and improvement in appetite and general well-being.

This case serves as an example of how TB can present as thymoma in adolescent patients, as well as how CT can be a poor discriminator between infectious and neoplastic diseases. Histopathological examination and microbiological confirmation are essential for establishing the diagnosis and guiding appropriate treatment.

Categories: Radiology, Internal Medicine, Infectious Disease
Keywords: adolescent, anterior mediastinal mass, case report, computed tomography, genexpert, histopathology, mediastinal tuberculosis, thymoma, tuberculoma, tuberculosis

Introduction

Anterior mediastinal masses present a diagnostic challenge because a wide range of neoplastic, inflammatory, and infectious conditions can involve this anatomical compartment. The other possible differential diagnoses are thymic epithelial tumors, undifferentiated lymphoblastoma, germ cell tumors, and infectious lesions. Clinical presentation and radiological findings may overlap, making it difficult to establish a definitive diagnosis using imaging alone [1-3].

Thymoma should be considered in the case of a mass lesion in the thymic area, even though it is not common in children and adolescent patients. Tuberculosis (TB) of the thymus is an extremely uncommon form of TB due to *Mycobacterium tuberculosis* (MTB). Clinically, TB of the thymus may appear as a localized mass that may present as a thymic neoplasm on radiology. Reported case studies have suggested that this is a rarely reported and diagnostically challenging condition and highlighted the need for histopathological and microbiological confirmation [4,5].

We report a case of TB involving the thymic region in a 16-year-old male, where the mass in the anterior mediastinum was initially thought to be a thymoma on computed tomography (CT) scan. The diagnosis was made from the histopathological examination of the excised tissue in addition to molecular testing. This case illustrates the necessity of considering TB as a disease despite other clinical and radiological evidence, especially in the context of TB endemicity, and the role of tissue diagnosis in the diagnosis of a mediastinal mass where other imaging features are inconclusive.

Case Presentation

A 16-year-old male presented to the Outpatient Department of a tertiary care hospital with a three-week history of intermittent low-grade fever, predominantly dry cough, reduced appetite, and unintentional weight loss of approximately 3 kg. The fever was not associated with chills or rigors. The patient also complained of mild non-specific retrosternal discomfort without severe chest pain, hemoptysis, orthopnea, or paroxysmal nocturnal dyspnea. The patient had no past history of dysphagia, facial swelling, or upper-limb edema. He denied ptosis, diplopia, dysphagia, or fatigability suggestive of myasthenia gravis. No history of TB was found, and the individual had no known contact with someone who was receiving care from a TB program. His medical and surgical histories were otherwise unremarkable, and he was not on any immunosuppressive drugs.

On examination, the patient was conscious, cooperative, and oriented to time, place, and person. His temperature was 37.8°C, pulse rate was 96 beats/minute, blood pressure was 110/70 mmHg, respiratory rate was 20 breaths/minute, and oxygen saturation was 98% on room air. There was no pallor, icterus, cyanosis, clubbing, or pedal edema. No significant cervical, supraclavicular, or axillary lymphadenopathy was detected. Respiratory examination included symmetrical chest movements and normal breath sounds, with no wheezing or crepitations. Cardiovascular examination was normal, with no murmurs heard. There were no clinical features of superior vena cava obstruction or neuromuscular weakness. Abdominal examination was unremarkable, with no palpable hepatosplenomegaly.

Initial laboratory investigations demonstrated mild anemia and an elevated erythrocyte sedimentation rate (ESR). The hemoglobin concentration was 11.4 g/dL, total leukocyte count was 9,800 cells/mm^3, and platelet count was 3.2 × 10^5 cells/mm^3. The ESR was 42 mm/hour, and the level of C-reactive protein was 18 mg/L. Levels of serum creatinine, aspartate aminotransferase, and alanine aminotransferase were 0.7 mg/dL, 25 U/L, and 22 U/L, respectively, and that of serum lactate dehydrogenase was 210 U/L. Levels of alpha-fetoprotein and beta-human chorionic gonadotropin in the serum were 2.8 ng/mL and <2 mIU/mL, respectively. The tumor marker results were not elevated according to the supplied laboratory interpretation. Pathological examination results were non-specific, and the cause of the mediastinal lesion was not determined. The results are presented in Table *1*.

Investigation	Patient's result	Standard reference range	Interpretation
Hemoglobin	11.4 g/dL	Male: 13.0-17.0 g/dL	Low
Total leukocyte count	9,800 cells/mm^3	4,000-11,000 cells/mm^3	Within normal limits
Platelet count	3.2 × 10^5 cells/mm^3	150,000-450,000 cells/mm^3	Within normal limits
Erythrocyte sedimentation rate (ESR)	42 mm/hour	Male: 0-15 mm/hour	Elevated
C-reactive protein (CRP)	18 mg/L	<5 mg/L	Elevated
Serum creatinine	0.7 mg/dL	0.7-1.3 mg/dL	Within normal limits
Aspartate aminotransferase (AST)	25 U/L	10-40 U/L	Within normal limits
Alanine aminotransferase (ALT)	22 U/L	7-56 U/L	Within normal limits
Lactate dehydrogenase (LDH)	210 U/L	140-280 U/L	Within normal limits
Alpha-fetoprotein (AFP)	2.8 ng/mL	<10 ng/mL	Not elevated
Beta-human chorionic gonadotropin (β-hCG)	<2 mIU/mL	Adult male: <5 mIU/mL	Not elevated

TABLE 1: Laboratory Investigations

A chest radiograph demonstrated widening of the superior mediastinal contour, raising suspicion of an anterior mediastinal lesion. Contrast-enhanced computed tomography (CECT) of the thorax was subsequently performed for further characterization. It demonstrated a large anterior mediastinal mass in the thymic region, measuring approximately 5.8 × 3.2 × 9.2 cm. The lesion showed heterogeneous post-contrast enhancement, internal areas of non-enhancement, and peripheral calcification. No definite invasion of adjacent major vascular structures or associated mediastinal lymphadenopathy was identified (Figure *1*). No significant pleural effusion or pulmonary parenchymal lesion was observed on the initial thoracic imaging. The initial radiological impression favored thymoma.

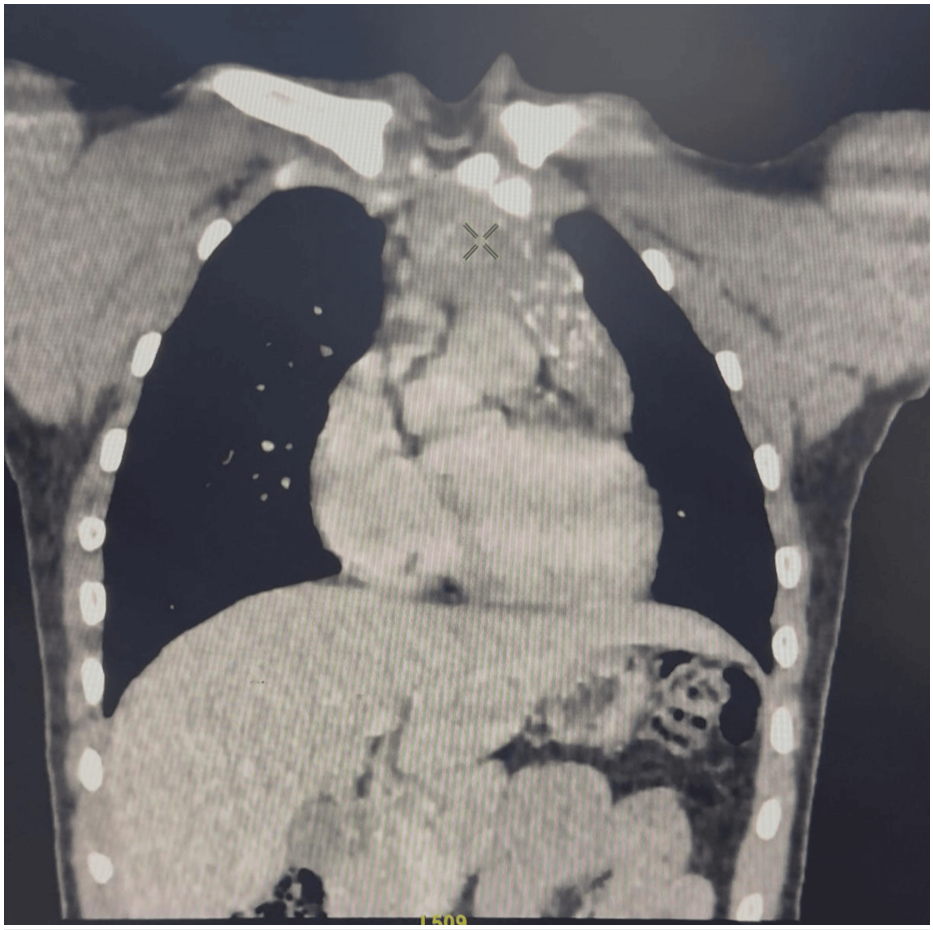


FIGURE 1: Contrast-Enhanced Computed Tomography of the Thorax

Contrast-enhanced computed tomography of the thorax showing a large anterior mediastinal mass measuring approximately 5.8 × 3.2 × 9.2 cm, with heterogeneous enhancement, internal non-enhancing areas, and peripheral calcification. The lesion was initially suspected to represent a thymic neoplasm.

The patient's young age, constitutional symptoms, and the presence of internal non-enhancing components prompted consideration of alternative diagnoses. Thymoma, lymphoma, mediastinal germ cell tumor, and tuberculous granulomatous disease were the main differential diagnoses considered. Thymoma was taken into account due to the heterogeneous enhancement and location in the thymic region, but it is rare in adolescents. Lymphoma remained a consideration because of the patient's age and constitutional symptoms; however, the absence of peripheral lymphadenopathy did not exclude it. Mediastinal germ cell tumor was also considered because these tumors may demonstrate heterogeneous enhancement, necrosis, and calcification. If there were no elevation of serum tumor markers, this would not rule out all subtypes of germ cell tumors. TB was also considered because granulomatous infection can involve mediastinal structures and, rarely, the thymus, producing a mass that mimics a neoplasm. Given the nonspecific imaging findings, tissue examination was required for definitive diagnosis.

Following multidisciplinary evaluation involving the radiology, thoracic surgery, and pathology teams, surgical excision was planned because of a strong suspicion of thymic malignancy based on the radiological appearance of the anterior mediastinal mass. The lesion was considered surgically resectable, and complete excision was favored for both diagnostic and therapeutic purposes. Although preoperative tissue sampling was an alternative, the multidisciplinary team preferred upfront surgical resection because of the concern for a resectable thymic neoplasm. The patient subsequently underwent thymectomy under general anesthesia. Intraoperatively, a well-defined mass was identified in the anterior mediastinum in the thymic region and was completely excised. The resected specimen was submitted for histopathological examination. The postoperative course was uneventful, and the patient was discharged after appropriate observation.

Gross examination of the resected specimen demonstrated a firm, irregularly lobulated mass with pale yellow-white areas on the cut surface. Microscopic examination revealed multiple epithelioid cell granulomas containing multinucleated giant cells, with central areas of caseous necrosis and surrounding lymphocytic inflammation. No normal thymic tissue or convincing thymic epithelial neoplasm was identified in the examined sections. Ziehl-Neelsen staining demonstrated acid-fast bacilli. Cartridge-based

nucleic acid amplification testing (CBNAAT) performed on the tissue specimen detected MTB complex without rifampicin resistance. Mycobacterial culture of the tissue specimen was also positive for MTB. Respiratory evaluation showed negative sputum acid-fast bacilli staining and negative sputum CBNAAT. The combined histopathological and microbiological findings confirmed TB involving the anterior mediastinal region.

Following confirmation of TB, the patient was evaluated for additional sites of disease and factors that could influence treatment selection. No additional site of active TB was identified during the initial evaluation. The patient was started on regular first-line anti-tubercular drug therapy under the supervision of a specialist after evaluating the molecular results, baseline liver and renal function, and other relevant clinical parameters. The treatment consisted of a standard two-month regimen of isoniazid, rifampicin, pyrazinamide, and ethambutol, followed by a four-month continuation phase with isoniazid and rifampicin. Counseling was provided regarding treatment adherence, potential adverse effects, and the need for clinical and biochemical monitoring.

At the two-week follow-up, the patient reported resolution of fever and improvement in appetite and general well-being. At six months, the patient remained clinically well, without recurrent constitutional symptoms, and had completed the treatment course without significant adverse effects.

Discussion

Anterior mediastinal masses encompass a broad spectrum of non-neoplastic and neoplastic conditions. Thymic lesions, lymphoma, germ cell tumors, and thyroid-related diseases are the main differential diagnoses. When assessing these lesions, the age of the patient is an important factor to consider. Thymoma rarely develops in children and adolescents [1-3], and so alternative diagnoses are important in this age group. Clinical symptoms and radiological findings may overlap, especially when inflammation, necrosis, or granulomatous changes are present. The combination of the location of the lesion in the thymic region, heterogeneous enhancement, non-enhancing areas in the lesion, and peripheral areas of calcification initially favored the diagnosis of thymoma in the present case. However, subsequent histopathological and molecular diagnostic results confirmed TB as the true cause of illness. This discrepancy illustrates the limitations of relying on CT alone to determine the histological nature of an anterior mediastinal mass.

Tuberculous involvement of the thymus is extremely rare. Mediastinal involvement with TB may involve the lungs and is usually secondary, but isolated or predominant thymic involvement is unusual and can present a diagnostic challenge. Earlier case reports have described thymic TB that was diagnosed as a thymic neoplasm [4-9]. Simmers et al. described a middle-aged woman who presented with a mediastinal mass and underwent sternotomy, with TB of the thymus diagnosed in the postoperative period [4]. Sacco et al. reported on a young girl who presented with a partially necrotic mass in the anterosuperior mediastinum, with caseation and granulomatous inflammation seen on pathological examination of the excised specimen [5]. Valooran et al. provided descriptions of mediastinal TB coupled with the myasthenia-thymoma complex [6]. TB of the thymus was also reported by FitzGerald et al. [7]. Iwata et al. described two patients who underwent surgical intervention and were evaluated preoperatively with thallium-201 single-photon emission CT [8]. Pradhan and Khadka reported TB presenting as an anterior mediastinal mass [9]. These reports further illustrate that although thymic TB is uncommon, it is considered a mimic of thymic neoplasia. The present case adds to this limited literature by describing a similar diagnostic challenge in an adolescent male whose lesion was initially considered a thymic tumor on imaging.

CECT is essential for characterizing anterior mediastinal masses and evaluating their dimensions, internal architecture, enhancement pattern, calcification, and relationship to adjacent structures [1-3]. In this case, the lesion measured 5.8 × 3.2 × 9.2 cm and demonstrated heterogeneous enhancement, internal non-enhancing areas, and peripheral calcification. Heterogeneous enhancement may reflect variations in tissue composition or vascularity, whereas non-enhancing regions may correspond to necrosis or cystic components. Calcification is a process that tends to happen in some neoplastic and non-neoplastic lesions. These findings are therefore not specific to TB and must be interpreted in conjunction with the patient's clinical presentation and other investigations. Although CT initially favored thymoma, it could not reliably distinguish neoplastic disease from granulomatous infection in this patient. Imaging was valuable for defining the lesion and informing preoperative assessment, but definitive diagnosis required tissue examination.

Histopathological and microbiological examinations were important in the diagnosis. Within the clinical context, epithelioid granulomas with central caseous necrosis and multinucleated giant cells were seen, supporting the diagnosis of TB. Granulomatous inflammation is not pathognomonic for TB; however, it may occur in other infectious and non-infectious conditions. In cases where there is a microbiological finding, histopathological evidence needs to be interpreted in combination with microbiological identification. In the present case, Ziehl-Neelsen staining demonstrated acid-fast bacilli, and nucleic acid amplification testing of the tissue detected MTB complex without rifampicin resistance. The concordance of the histopathological findings with the microbiological results provided strong evidence for the diagnosis. Molecular testing also supplied information regarding rifampicin resistance, although this result alone does not establish susceptibility to all antitubercular drugs. Culture and additional drug-susceptibility testing may

provide further information when clinically indicated and feasible. Establishing the diagnosis is important because an incorrect presumption of malignancy may lead to unnecessary investigations or interventions, whereas failure to recognize TB may delay appropriate antimicrobial treatment.

The management of a mass in the anterior mediastinum is dependent upon the suspected diagnosis, anatomical relationship, clinical status, and diagnostic investigations. Lymphoma and germ cell tumors require diagnosis-specific evaluation, and tissue sampling may be necessary before definitive treatment. For selected patients, image-guided biopsies will be used to make a diagnosis and may eliminate the need for major surgery. On the other hand, surgical resection is indicated if a diagnosis of resectable thymic epithelial tumor is strongly suspected after multidisciplinary evaluation. In the current case, the lesion initially appeared to be a thymic neoplasm, and for this reason, thymectomy was performed. The excised tissue was examined, and a diagnosis of TB was established. This clinical course illustrates how an uncommon infectious condition may be identified after surgical excision of a lesion suspected to be neoplastic; it does not imply that surgery is necessary in every patient with suspected thymic TB. When TB is included in the differential diagnosis, the diagnostic approach should be individualized to establish the diagnosis safely and promptly while considering the risks of biopsy, the likelihood of malignancy, and the feasibility of microbiological testing.

This case highlights several clinically relevant lessons. First, age should inform the differential diagnosis of an anterior mediastinal mass, particularly because thymoma is uncommon in adolescents. Second, heterogeneous enhancement, internal non-enhancing areas, and calcification are not independently diagnostic of a thymic neoplasm. Third, TB should be considered among the possible causes of an atypical mediastinal mass, particularly in regions where TB is prevalent. Finally, histopathological examination combined with appropriate microbiological testing can establish an unexpected diagnosis and guide subsequent management. Collaboration among radiologists, thoracic surgeons, pathologists, and clinicians is important when the clinical and radiological findings do not provide a definitive diagnosis.

An important limitation of this case is that normal thymic tissue was not identified in the examined histopathological sections. Although the lesion was located in the thymic region, its precise anatomical origin could not be established, and tuberculous involvement of adjacent mediastinal tissue cannot be completely excluded. Therefore, the diagnosis is best described as TB involving the thymic region rather than definitively established primary thymic TB.

Conclusions

Thymic TB is a rare cause of an anterior mediastinal mass and may mimic thymoma on CECT. In this adolescent male, a large mediastinal lesion with heterogeneous enhancement, internal non-enhancing areas, and peripheral calcification was initially interpreted as thymoma. Histopathological examination and molecular testing subsequently established the diagnosis of TB involving the thymic region. This case highlights the limitations of imaging-based tissue characterization and emphasizes the importance of considering TB in the differential diagnosis of atypical anterior mediastinal masses, particularly in TB-endemic regions. Integrating clinical findings, radiological assessment, histopathology, and microbiological testing is essential for accurate diagnosis and appropriate management.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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