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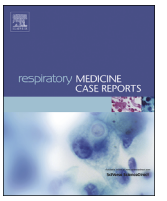

Case Report

# Inflammatory myofibroblastic tumors: Diagnostic challenges and treatment strategies - A case report and literature review

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ABSTRACT

Inflammatory myofibroblastic tumors (IMTs) are rare benign mesenchymal tumors that present diagnostic challenges due to their diverse clinical and radiological manifestations. We present a case of a 19-year-old female with a history of intermittent hemoptysis. Imaging studies suggested a mediobasal lung lesion, prompting further evaluation. Bronchoscopy revealed vascular changes, and PET imaging indicated high metabolic activity. A left lower lobectomy was performed for diagnostic and therapeutic purposes, confirming the diagnosis of IMT characterized by spindle cell proliferation and inflammatory infiltrates. Surgical resection remains the cornerstone treatment, offering favorable outcomes with rare recurrence. Follow-up underscores the importance of monitoring and assessing prognostic factors to optimize patient management.

## 1. Introduction

Inflammatory myofibroblastic tumors (IMTs) are rare benign mesenchymal tumors, with a prevalence ranging between 0.04 % and 0.7 % [1]. IMTs are most commonly found in the lungs, but cases have been reported in almost every location and system in the literature [2–5]. These tumors, which often pose diagnostic challenges, are frequently see in young individuals.Figure 2, 3 and 4

Although the exact mechanisms of IMT formation are not well understood, trauma, surgical inflammation, and immunological factors are believed to play a role. Nonspecific symptoms and radiological findings during the diagnostic stage can complicate accurate diagnosis. Therefore, clinical and histopathological examinations are of great importance.

Due to their rarity, IMTs are often overlooked during the diagnostic process, leading to difficulties in diagnosis. Consequently, surgical resection becomes a viable option during the patient's diagnosis process, allowing for simultaneous treatment planning.

In this case, we aim to focus on the diagnostic and treatment process of IMTs, which are rare, often mistaken for malignancies, and have a broad differential diagnosis spectrum.

## 2. Case report

Our patient is a 19-year-old female with a two-year history of intermittent bloody sputum, but she had not sought medical attention for this complaint. Five days ago, she experienced approximately 5 cc of hemoptysis, prompting her to visit our clinic. The patient had no history of chronic diseases or medication use. She was a non-smoker, a university student, and residing in a student dormitory. She had no history of trauma or surgery. When questioned about frequent infections, no significant findings were reported. Physical examination revealed no abnormalities.

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Five days prior, she had sought medical attention at another facility for her bloody sputum. A chest CT from the outside center revealed an irregularly contoured lesion measuring 43 × 35 mm in soft tissue density in the mediobasal segment of the left lower lobe, with adjacent ground-glass opacities (Fig. 2 and 3). Dynamic magnetic resonance imaging was recommended for further evaluation with preliminary diagnoses of sequestration and bronchogenic cyst (Fig. 1).

Laboratory tests of complete blood count, coagulation parameters, liver and kidney function tests, vasculitis markers, connective tissue markers, sputum acid-fast bacilli (AFB), and sputum mycobacterial culture were analysed. No pathological results were found in these tests.

Bronchoscopy showed increased vascularization of the entire bronchial system. The entrance to the posterobasal segment of the left lower lobe was significantly narrowed by an external compression from the anteromedial side. The mucosa in the area of external

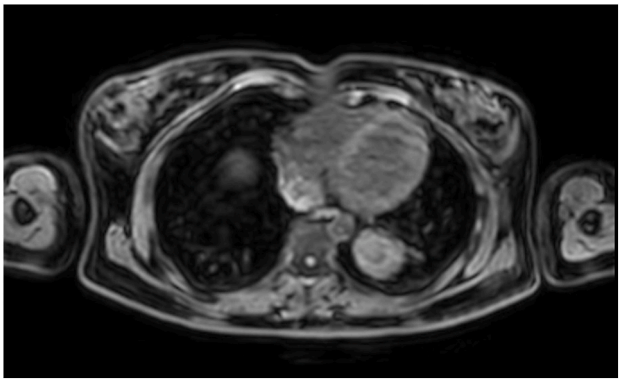

**Fig. 1.** Dynamic magnetic resonance imaging of patient

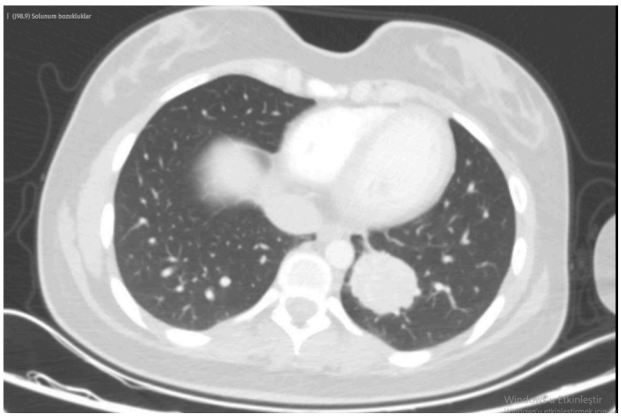

**Fig. 2CC.** Chest CT imaging of patient - parenchymal window

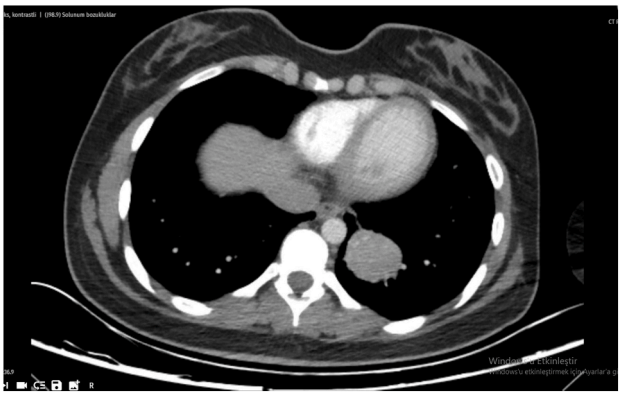

**Fig. 3.** Chest CT imaging of patient - mediastinal window

compression was smooth-surfaced but had dense vascularization. Lavage was taken from the posterobasal segment of the left lower lobe. No pathological cells were seen in the lavage, no growth was found in the mycobacterial culture, and AFB was negative.

PET imaging showed hypermetabolism at malignancy levels (SUVmax: 32.1) in the lesion measuring 43 × 35 mm in the mediobasal segment of the left lower lobe.

Dynamic magnetic resonance imaging taken at the outside center showed a T2A hypointense appearance with a suspicious membrane area centrally, adding stage II-IV hydatid cyst to the differential diagnosis. The patient's indirect hemagglutination test for hydatid cyst, which was requested with a preliminary diagnosis of hydatid cyst, was negative, and abdominal ultrasound revealed no pathology. The IgG4 value in the IgG subgroups requested with a preliminary diagnosis of IgG4-related disease was found to be 2.73 g/L.

During a period without active hemoptysis, a pulmonary function test was performed for preparation of surgery, showing FEV1 at 2.30 L, 64 %; FVC at 2.74 L, 67 %; and FEV1/FVC at 99 %.

The patient was discussed at the surgical council. With a preliminary diagnosis of mesenchymal tumor, a left lower lobectomy was planned for diagnostic and therapeutic purposes.

Pathological examination of the resected left lower lobectomy specimen revealed spindle cell proliferation that destructively replaced the lung parenchyma, forming short fascicles and whorls. There were also dense mixed inflammatory cells, focal foamy histiocyte clusters, and centrally located, relatively cell-poor sclerotic areas, consistent with the pathological diagnosis of inflammatory myofibroblastic tumor.

In the differential diagnosis, IgG4-related disease was considered, but immunohistochemical examination showed the IgG4/IgG ratio to be well below 40 %, excluding this possibility.

After consulting with medical oncology, it was deemed appropriate to monitor the patient's condition. Follow-up is ongoing (Fig. 4).

## 3. Discussion

Inflammatory myofibroblastic tumors (IMTs) can occur throughout the body but are most commonly found in the lungs as generally benign mesenchymal tumors. Pulmonary IMTs account for approximately 0.7 % of all lung tumors. They occur equally in both genders and are most frequently seen in the second decade of life. No tendencies have been reported concerning geography or ethnicity [6].

IMTs were named by Umiker and colleagues in 1954 due to their tendency to mimic a malignant process clinically and radiologically [7]. In earlier literature, they were also described with names such as inflammatory pseudotumor, plasma cell granuloma, fibroxanthoma, and inflammatory fibrosarcoma [7,8].

The etiology of IMT is not clear, but it is believed that trauma, surgical inflammation, and immune-autoimmune causes (such as IgG4-related autoimmune disease, vasculitis with anti-C3 and antifibrinogen deposition in the vascular wall) play a role in the pathology [7,9]. Additionally, certain microorganisms, such as Nocardia, Mycoplasma, Klebsiella, Pseudomonas aeruginosa, Helicobacter pylori, Coxiella burnetti, and Epstein-Barr virus, have been implicated in the pathogenesis of IMT [10].

Histologically, IMT is a neoplasm that includes lymphocytes, plasma cells, myofibroblastic spindle cells, and collagen, formed as a result of acute or chronic inflammation. The presence of both T and B lymphocytes in the histopathology of IMT is a critical feature in distinguishing this disease from lymphoma [11].

Patients can present with nonspecific clinical symptoms such as cough, hemoptysis, fever, weight loss, dyspnea, anemia, growth retardation, and hypergammaglobulinemia [7–9]. According to a recent study, approximately 70 % of IMT patients are asymptomatic [12]. Our patient presented to us with hemoptysis.

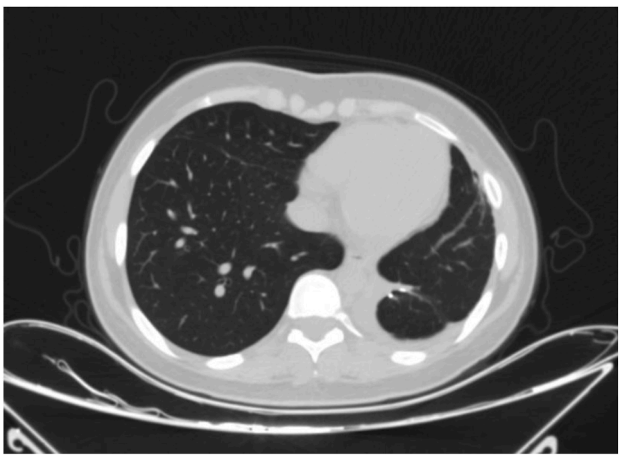

**Fig. 4.** Chest CT imaging of patient after surgery

Imaging findings are similar to primary lung cancers, metastases, pulmonary sequestration, cryptogenic organizing pneumonia, thoracic soft tissue sarcoma, chondroma, granuloma, and hamartoma [13,14]. IMTs typically involve the lung parenchyma, while mediastinal and tracheobronchial involvement is rarer [15].

Our case involved a 19-year-old female patient who presented with intermittent bloody sputum. While this symptom can be among the clinical manifestations of tumors like IMT, it can also be associated with many other diseases, creating a broad differential diagnosis spectrum.

The patient's radiological imaging results highlight the fact that IMTs typically involve the lung parenchyma and can mimic malignant tumors in appearance.

During the diagnostic process, potential differential diagnoses included IgG4-related disease and hydatid cyst. However, the patient's immunological examinations ruled out IgG4-related disease. This underscores the importance of confirming the diagnosis of IMT with clinical and laboratory findings.

Surgical resection is often the preferred method for treating inflammatory myofibroblastic tumors. This treatment option is crucial for achieving local control of the lesion and ruling out potential malignancy. In our case, surgical resection was chosen, and a left lower lobectomy was performed. Surgery, by ensuring complete removal of the lesion, can enhance the patient's long-term survival. The overall 3-year survival rate is approximately 82 %, and the 5-year survival rate is about 74 %. Recurrence is rare after complete resection. Outcomes in patients who undergo radical resection are generally favorable [6].

Jones and colleagues' (2024) prospective study demonstrates that surgical treatment of pulmonary IMT is effective, contributing to rapid symptom improvement and long-term survival. However, the rarity of pulmonary IMT and diagnostic challenges complicate the determination of surgical options and the adoption of the correct surgical approach. More prospective studies are needed to standardize post-surgical follow-up and evaluate long-term outcomes. These studies could guide the surgical management of pulmonary IMT patients and improve treatment outcomes.

Another factor affecting survival is distant organ metastasis, which is observed in only 5 % of cases [16].

However, due to the rarity and benign appearance of IMT, alternative treatment options should also be considered. In some cases, adjuvant treatment methods such as radiotherapy or immunotherapy may be used post-surgery. Particularly in cases that are unsuitable for surgery or recurrent cases, these treatment modalities can play a crucial role. The appropriate dose for radiation therapy has not been established. Chemotherapy is used for systemic lesions. Platinum-containing chemotherapy regimens have been reported to be beneficial. Additionally, considering the presumed immunological origin of IMT, new treatment approaches such as immunotherapy should also be explored. However, it is known that these treatments do not increase disease-free survival as much as surgery does.

Smith and colleagues' (2023) molecular analysis study provides a comprehensive insight into IMT. This study represents an important step in understanding the molecular mechanisms in the pathogenesis of IMT. Smith and his team investigated the impact of changes in the ALK (Anaplastic Lymphoma Kinase) gene on the clinical features of IMT. Their findings revealed a higher recurrence risk and aggressive clinical features in ALK-positive IMT cases. These results suggest that therapeutic strategies targeting ALK gene activation may potentially be effective in the treatment of IMT. Smith and his team's study has contributed to a better understanding of the molecular foundations of IMT and the development of more effective treatment options for patients.

The follow-up process involves regular clinical evaluations and monitoring of lesions through imaging methods in IMT patients. Despite the rarity of IMT and its low recurrence risk, recurrence can occur in some cases. Local recurrence is one of the most significant factors affecting survival. Local recurrence is particularly observed in cases where complete surgery has not been performed. Therefore, frequent follow-ups, especially in the first few years, are crucial.

Evaluating prognostic factors is also an important part of the follow-up process. The histopathological characteristics of IMT, the size of the lesion, its localization, and the status of surgical margins can all affect the patient's prognosis. Considering these factors is critical for the long-term monitoring of the patient and for adjusting the treatment plan if necessary.

## 4. Conclusion

In conclusion, the diagnosis and treatment of rare tumors like IMT require careful evaluation of clinical and radiological findings. Accurate diagnosis, appropriate treatment, and regular follow-up are critical for patients' survival and quality of life. Therefore, when encountering rare tumors like IMT, a multidisciplinary approach should be adopted.

It is important to consider this diagnosis in the differential diagnosis of other soft tissue tumors. This can help prevent unnecessary radical surgeries.

## CRediT authorship contribution statement

**Betul Kinik:** Writing – review & editing, Investigation, Resources, Writing – original draft. **Seda Tural Onur:** Investigation, Supervision, Writing – review & editing. **Asli Bicen:** Investigation. **Kaan Kara:** Investigation, Writing – original draft. **Cemal Aker:** Investigation.

## Declaration of competing interest

All authors declared that conflicts do not exist.

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