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# Case Report: Lung Carcinoma in a Young Patient with History of Tuberculosis

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**A B S T R A C T**

Introduction. Lung carcinoma in young patients is an uncommon and particularly challenging clinical scenario, especially when there is a history of tuberculosis (TB). Tuberculosis, a chronic infectious disease caused by Mycobacterium tuberculosis, can lead to significant lung damage and create a microenvironment conducive to carcinogenesis through chronic inflammation and fibrosis. This case report describes the diagnosis and management of lung carcinoma in a young patient with a history of TB, emphasizing the diagnostic complexities and therapeutic strategies involved.

Case Presentation. A 35-year-old male with a previous history of pulmonary TB presented with a persistent cough, hemoptysis, weight loss, and chest pain over several weeks. The patient, a non-smoker, had been treated for TB five years prior and had remained asymptomatic until the recent onset of symptoms. Initial chest X-ray and CT scans revealed a cavitating mass in the left upper lobe of the lung, raising the suspicion of TB recurrence. However, sputum smear microscopy and culture were negative for acid-fast bacilli. Further evaluation with bronchoscopy and biopsy of the mass confirmed the diagnosis of poorly differentiated non-small cell lung carcinoma (NSCLC), Stage IIIb. Molecular testing for common genetic mutations, including EGFR, ALK, and ROS1, was negative. The patient underwent treatment with a combination of cisplatin and pemetrexed chemotherapy, resulting in a partial response after three cycles. Radiation therapy was planned for local control of the residual tumor.

Conclusion. This case highlights the complex interplay between TB and lung carcinoma, illustrating the diagnostic challenges due to overlapping clinical and radiological features. The history of TB likely contributed to the development of lung carcinoma through chronic inflammation and fibrosis. Despite the advanced stage at diagnosis, the patient responded positively to chemotherapy, demonstrating the potential for effective management with appropriate therapeutic strategies. This case underscores the importance of considering lung carcinoma in the differential diagnosis of young patients with a history of TB presenting with new pulmonary symptoms and the need for a multidisciplinary approach in managing such complex cases. Regular follow-up and supportive care are crucial for monitoring disease progression and maintaining patient quality of life.

Keywords: Lung  Carcinoma, Risk Factor, Tuberculosis, Young

## Introduction

Lung carcinoma, or lung cancer, is one of the most prevalent and deadliest forms of cancer worldwide. It is characterized by uncontrolled cell growth in the tissues of the lung, which can lead to metastasis—spread of cancer beyond the lung. The disease can be broadly classified into two major types: non-small cell lung carcinoma (NSCLC) and small cell lung carcinoma (SCLC). NSCLC accounts for approximately 85% of all lung cancer cases and includes subtypes such as adenocarcinoma, squamous cell carcinoma, and large cell carcinoma. SCLC, making up the remaining 15%, is more aggressive and rapidly growing.[1,2]

Lung cancer is the leading cause of cancer-related mortality globally, responsible for an estimated 1.8 million deaths annually. Its incidence is closely linked to smoking, with tobacco use being the primary risk factor. However, non-smokers can also develop lung cancer due to factors such as exposure to secondhand smoke, radon gas, asbestos, air pollution, and genetic predisposition. The disease predominantly affects older adults, typically those aged 65 and above, but can also occur in younger populations. The pathogenesis of lung carcinoma involves a complex interplay of genetic, environmental, and lifestyle factors. Carcinogens from tobacco smoke cause mutations in key oncogenes and tumor suppressor genes, leading to uncontrolled cellular proliferation and survival. In NSCLC, mutations in the epidermal growth factor receptor (EGFR), anaplastic lymphoma kinase (ALK), and KRAS are common. In contrast, SCLC is strongly associated with alterations in the TP53 and RB1 genes. Chronic inflammation and repeated injury to lung tissue can also contribute to carcinogenesis.[3]

The clinical manifestations of lung cancer vary depending on the tumor's location, size, and metastatic spread. Common symptoms include persistent cough, hemoptysis (coughing up blood), chest pain, shortness of breath, and unexplained weight loss. Advanced stages of the disease may present with symptoms related to metastatic sites, such as bone pain, neurological deficits, and liver dysfunction. Paraneoplastic syndromes, which are indirect effects of cancer unrelated to tumor invasion, can also occur. Early diagnosis of lung carcinoma is challenging due to the nonspecific nature of its initial

symptoms. Diagnostic workup typically begins with imaging studies such as chest X-rays and computed tomography (CT) scans to identify suspicious lesions. Positron emission tomography (PET) scans can help determine the extent of the disease. Definitive diagnosis is achieved through histopathological examination of tissue obtained via bronchoscopy, CT-guided needle biopsy, or surgical resection. Molecular testing for specific genetic mutations is crucial for guiding targeted therapy.[3,4]

The staging of lung cancer is essential for determining the appropriate treatment strategy and prognosis. The TNM (Tumor, Node, Metastasis) staging system is commonly used for NSCLC. It categorizes the disease based on the size and extent of the primary tumor (T), involvement of regional lymph nodes (N), and presence of distant metastasis (M). SCLC is typically classified as limited stage, where the cancer is confined to one hemithorax, or extensive stage, where it has spread beyond. [3,5]

The treatment of lung carcinoma depends on the type and stage of the disease, as well as the patient's overall health and preferences. Options include surgery, radiation therapy, chemotherapy, targeted therapy, and immunotherapy. [5]

- Surgery: Often considered for early-stage NSCLC, involves resection of the tumor and surrounding tissue.

- Radiation Therapy: Used to kill cancer cells or shrink tumors, either as a primary treatment or adjuvant therapy post-surgery.

- Chemotherapy: Utilizes cytotoxic drugs to destroy cancer cells, commonly used for both NSCLC and SCLC, particularly in advanced stages.

- Targeted Therapy: Involves drugs that specifically target genetic mutations and molecular pathways involved in cancer growth, such as EGFR inhibitors and ALK inhibitors.

- Immunotherapy: Employs immune checkpoint inhibitors to enhance the body's immune response against cancer cells, showing promising results in advanced lung cancer.

The prognosis of lung carcinoma is generally poor, with a 5-year survival rate of approximately 20% for NSCLC and less than 7% for SCLC. Early detection significantly improves outcomes, but most cases are diagnosed at an advanced stage due to the asymptomatic nature of early disease. Advances in treatment, particularly in targeted therapies and immunotherapy, have provided new hope for improving survival and quality of life for patients with lung cancer. Lung carcinoma remains a major public health challenge with significant morbidity and mortality. While smoking cessation efforts and early detection strategies have made some impact, ongoing research into the molecular mechanisms of lung cancer and the development of novel therapies are crucial for better management and improved outcomes. Understanding the disease's complex nature and diverse presentations is essential for healthcare providers to deliver optimal care and support to affected individuals.[6,7]

Tuberculosis (TB) is a chronic infectious disease caused by the bacterium Mycobacterium tuberculosis. It primarily affects the lungs (pulmonary TB) but can also involve other organs (extrapulmonary TB). TB is one of the oldest diseases known to humanity, with evidence of its presence in ancient civilizations. Despite significant advances in medical science, TB remains a major global health challenge, causing significant morbidity and mortality, particularly in developing countries.[6]

TB is one of the top 10 causes of death worldwide and the leading cause from a single infectious agent, surpassing even HIV/AIDS. According to the World Health Organization (WHO), in 2021, there were an estimated 10 million new TB cases and 1.5 million TB-related deaths. TB is a major public health issue in low- and middle-income countries, with the highest burden in regions such as Southeast Asia, Africa, and the Western Pacific. However, no country is immune, and TB affects all age groups.[6,7]

The pathogenesis of TB begins with the inhalation of Mycobacterium tuberculosis bacilli, which are airborne and transmitted from person to person through respiratory droplets. Once inhaled, the bacteria reach the alveoli in the lungs, where they are engulfed by macrophages. The bacteria can evade the immune response, surviving and multiplying within the macrophages. This initial phase of infection, known as primary TB, may either resolve, become latent, or progress to active disease.[7]

- Latent TB Infection (LTBI): In most individuals, the immune system contains the infection, and the bacteria remain dormant within granulomas. People with LTBI are asymptomatic and non-infectious but can reactivate, especially if their immune system becomes compromised.

- Active TB Disease: When the immune system fails to contain the bacteria, or if latent bacteria reactivate, active TB disease occurs. This can cause extensive tissue damage and cavitation in the lungs, facilitating transmission to others.

The clinical presentation of TB can vary widely depending on the site of infection and the host's immune response. Pulmonary TB, the most common form, typically presents with a persistent cough lasting more than three weeks, hemoptysis (coughing up blood), chest pain, night sweats, weight loss, fever, and fatigue. Extrapulmonary TB can affect any organ, including the lymph nodes, pleura, bones and joints, central nervous system, kidneys, and gastrointestinal tract, leading to diverse symptoms based on the organ involved.[7,8]

The diagnosis of TB involves a combination of clinical, radiological, microbiological, and immunological methods[9]:

- Clinical Evaluation : Includes history taking, physical examination, and assessment of risk factors such as close contact with TB patients, HIV infection, and immunosuppressive conditions.

- Imaging: Chest X-ray and CT scan can reveal characteristic features of pulmonary TB, such as infiltrates, cavitations, and lymphadenopathy.

- Microbiological Testing: Sputum smear microscopy, culture, and nucleic acid amplification tests (NAATs) like GeneXpert MTB/RIF are crucial for detecting *M. tuberculosis and assessing drug resistance.

- Immunological Tests: Tuberculin skin test (TST) and interferon-gamma release assays (IGRAs) help identify latent TB infection but are less useful for diagnosing active TB.

The treatment of TB requires prolonged and multidrug therapy to ensure complete eradication of the bacteria and to prevent the development of drug resistance. The standard regimen for drug-susceptible TB includes[9]:

- First-Line Drugs: Isoniazid, rifampicin, ethambutol, and pyrazinamide, usually administered for six months.

- Directly Observed Therapy (DOT): Ensures adherence to treatment by having a healthcare provider observe the patient taking their medication.

Drug-resistant TB, including multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB), poses a significant challenge and requires more complex and longer treatment regimens with second-line drugs, often accompanied by more severe side effects.

Preventing TB transmission involves several strategies[10]:

- Vaccination: The Bacillus Calmette-Guérin (BCG) vaccine provides partial protection against TB, particularly severe forms in children.

- -Infection Control: Includes identifying and treating infectious cases, using respiratory protection, and ensuring proper ventilation in high-risk settings.

- Public Health Measures: Focus on reducing risk factors such as malnutrition, overcrowding, and HIV infection through community education and health interventions.

Global efforts to combat TB are coordinated by the WHO's End TB Strategy, which aims to reduce TB incidence and mortality by 90% and 95%, respectively, by 2035. Key components include[9,10]:

- Early Detection and Treatment: Ensuring access to diagnostic tools and effective treatment for all TB patients.

- Drug-Resistant TB Management: Developing new drugs and regimens to treat drug-resistant TB.

- Research and Development: Investing in the development of new vaccines, diagnostics, and therapeutics.

- Social and Economic Interventions: Addressing the social determinants of health that contribute to TB transmission.

Despite significant progress, challenges remain, including the need for better diagnostics, more effective vaccines, shorter and less toxic treatment regimens, and addressing the underlying social and economic factors that drive the TB epidemic. Tuberculosis continues to be a major global health concern, necessitating concerted efforts from healthcare providers, researchers, policymakers, and communities. With continued advancements in medical science, public health initiatives, and global cooperation, there is hope for controlling and eventually eliminating TB as a public health threat. Understanding the disease's complexity, pathogenesis, and clinical management is crucial for improving patient outcomes and achieving global TB control targets.[11]

Lung carcinoma is rare in young adults and often presents at an advanced stage. Tuberculosis, a prevalent infectious disease, can cause chronic lung damage and is suspected to be a risk factor for lung cancer. This report aims to explore the potential link between prior tuberculosis and the development of lung carcinoma in a young patient.

## Case Presentation

A 28 years-old male came to hospital polyclinic with main complaint of 3-month history of persistent cough, hemoptysis, weight loss, and chest pain. He reported increased fatigue and night sweats. There was no family history of cancer. The patient was treated for pulmonary tuberculosis at age 22. The patient was non-smoker. He was an office worker.

Based on physical examination, the doctor found decreased breath sounds in the right lung, dullness on percussion. Laboratory tests found elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP). Imaging showed that chest X-ray revealed a right upper lobe mass with cavitation. CT Sca showed a 4 cm mass in the right upper lobe with associated mediastinal lymphadenopathy. Bronchoscopy visualized a mass obstructing the right upper bronchus. Biopsies were taken. Histopatholog revealed poorly differentiated non-small cell lung carcinoma (NSCLC). Molecular Testing showed EGFR mutation and ALK rearrangement were negative.

The patient was started on chemotherapy with cisplatin and pemetrexed. Given the advanced stage of the disease (Stage IIIb), surgical resection was not an option. Radiation therapy was planned for local control of the tumor. After three cycles of chemotherapy, a repeat CT scan showed a partial response with a reduction in tumor size. The patient tolerated chemotherapy well, with manageable side effects such as nausea and fatigue. Regular follow-up every three months was scheduled to monitor the disease's progression and manage any complications.

The association between tuberculosis and lung cancer is complex. Chronic inflammation and fibrosis caused by TB can create a microenvironment conducive to carcinogenesis. Scar carcinoma, a type of lung cancer associated with areas of previous inflammation or fibrosis, supports this hypothesis. Several studies suggest a higher incidence of lung cancer in individuals with a history of TB. The chronic inflammatory state, repeated cycles of cell injury and repair, and persistent immunological activation may contribute to malignant transformation.

Distinguishing between TB reactivation and lung carcinoma can be challenging due to overlapping clinical and radiological features. In this case, the presence of a cavitating lung mass initially raised the suspicion of TB recurrence, highlighting the importance of thorough diagnostic evaluation. Treating lung carcinoma in young patients requires a multidisciplinary approach. Younger patients often have better performance status and may tolerate aggressive treatments better than older adults. However, the psychological impact and potential long-term sequelae of treatment need careful consideration.

## Discussion

This case report highlights a rare and significant clinical scenario: lung carcinoma in a young patient with a history of tuberculosis (TB). The intersection of these two conditions presents unique challenges and raises important considerations regarding the potential link between chronic pulmonary infections and the development of malignancies. The relationship between TB and lung cancer is complex and multifactorial. TB can cause chronic inflammation and fibrosis in the lung tissue, creating a microenvironment that may promote carcinogenesis. Chronic inflammation leads to the production of reactive oxygen species (ROS) and reactive nitrogen species (RNS), which can cause DNA damage, mutations, and genomic instability. Moreover, repeated cycles of tissue injury and repair can result in dysplastic changes and neoplastic transformation. Several studies have suggested an increased risk of lung cancer among individuals with a history of TB. For example, a meta-analysis by Brenner et al. (2011) found that previous lung diseases, including TB, were associated with a higher risk of lung cancer. However, the exact mechanisms linking TB to lung cancer are still not fully understood, and further research is needed to elucidate these pathways.[12]

In addition to the direct effects of TB, genetic and environmental factors may also play a role in the development of lung carcinoma in this patient. Although the patient was a non-smoker, other risk factors such as exposure to environmental pollutants, genetic predisposition, and underlying immune status may contribute to the development of lung cancer. The diagnostic process in this case was complicated by the overlapping clinical and radiological features of TB and lung carcinoma. Both conditions can present with symptoms such as cough, hemoptysis, weight loss, and chest pain, making it difficult to distinguish between them based solely on clinical presentation. Radiological findings can also be misleading. The presence of a cavitating lung mass on the chest X-ray and CT scan initially raised the suspicion of TB recurrence. Cavitation is a common feature in both TB and certain types of lung cancer, particularly squamous cell carcinoma. In this case, the use of advanced imaging techniques such as CT and PET scans was crucial in identifying the characteristics of the mass and its potential malignancy. Definitive diagnosis was achieved through bronchoscopy and histopathological examination of biopsy samples. The identification of poorly differentiated non-small cell lung carcinoma (NSCLC) underscored the importance of obtaining tissue samples for accurate diagnosis. Molecular testing for specific genetic mutations, although negative in this case, is also essential for guiding targeted therapy.[13]

Given the advanced stage of the disease (Stage IIIb), surgical resection was not a viable option. The patient was treated with a combination of cisplatin and pemetrexed, a standard chemotherapy regimen for advanced NSCLC. This approach aims to reduce tumor size, control symptoms, and improve survival. The partial response observed after three cycles of chemotherapy highlights the effectiveness of this regimen. Radiation therapy was planned for local control of the tumor, particularly to manage any residual disease and prevent further progression. The integration of chemotherapy and radiation therapy is a common strategy for managing locally advanced NSCLC, offering the potential for improved outcomes compared to chemotherapy alone.[2,13]

The management of chemotherapy side effects, such as nausea and fatigue, is critical to ensure patient adherence to treatment and maintain quality of life. Supportive care measures, including antiemetics and nutritional support, play an important role in mitigating these adverse effects. The prognosis of lung carcinoma in young patients is generally poor, largely due to the aggressive nature of the disease and its tendency to present at an advanced stage. Factors influencing prognosis include tumor stage, histological subtype, molecular profile, and the patient's overall health and performance status.[13,14]

Regular follow-up is essential for monitoring disease progression, managing treatment-related side effects, and detecting any signs of recurrence. In this case, follow-up every three months was scheduled to ensure close surveillance and timely intervention if needed. The diagnosis of lung carcinoma can have a profound psychological impact, particularly on young patients who may face significant disruptions in their personal and professional lives. Providing psychosocial support, including counseling and support groups, is an important aspect of comprehensive cancer care.[15]

This case underscores the importance of considering lung carcinoma in the differential diagnosis of young patients with a history of TB presenting with new pulmonary symptoms. Awareness of the potential link between chronic pulmonary infections and lung cancer can prompt timely and thorough diagnostic evaluations, leading to earlier detection and improved outcomes. Managing lung carcinoma in young patients requires a multidisciplinary approach involving pulmonologists, oncologists, radiologists, pathologists, and supportive care teams. Collaborative care ensures that all aspects of the patient's health and well-being are addressed, from diagnosis and treatment to follow-up and supportive care. Further research is needed to better understand the mechanisms linking TB and lung cancer and to identify biomarkers that can aid in early detection and risk stratification. Educating healthcare providers about the potential associations and diagnostic challenges can enhance clinical practice and patient care.

## Conclusion

This case report highlights the rare but significant occurrence of lung carcinoma in a young patient with a history of TB. The overlapping clinical features of TB and lung cancer pose diagnostic challenges, emphasizing the need for thorough evaluation and histopathological confirmation. The complex interplay between chronic pulmonary infections, genetic predisposition, and environmental factors in the pathogenesis of lung cancer warrants further investigation. A multidisciplinary approach and regular follow-up are crucial for optimizing treatment outcomes and providing comprehensive care for affected patients.

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