



Challenges in Diagnosing and Managing Pulmonary Conditions: A Case Series Highlighting Pulmonary Tuberculosis and Lung Cancer

Authors

Dr Rajendra Tatu Nanavare¹, Dr. Deepak Chaudhary²

¹Chest Physician and Unit Head in Unit 4, Medical Department Group of TB Hospital Sewri Mumbai, Faculty for Post Graduate Diploma in Chest and Tuberculosis, Tropical Medicine, in College of Physician and Surgeon CPS Mumbai

²Medical Officer Unit 4, Medical Department, Group of TB Hospital Sewri Mumbai
Corresponding Author

Dr Rajendra Tatu Nanavare

Chest Physician and Unit Head in Unit 4, Medical Department Group of TB Hospital Sewri Mumbai, Faculty for Post Graduate Diploma in Chest and Tuberculosis, Tropical Medicine, in College of Physician and Surgeon CPS Mumbai

Abstract

This study delves into the intricate challenges encountered in diagnosing and managing pulmonary conditions, focusing on tuberculosis (TB) and lung cancer, especially in individuals with a history of cancer treatment and tobacco use. Through a detailed analysis of clinical cases, we explore the complexities associated with TB reactivation post-cancer therapy and the hurdles in timely diagnosing lung cancer in tobacco users.

Three cases are presented:

A 60-year-old male with a history of pulmonary TB, bidi smoking, and a diagnosis of adenocarcinoma after presenting with persistent cough and imaging findings suggestive of lung cancer.

A 57-year-old male, post-cancer treatment, presenting with cough, diagnosed with TB after immunosuppression, highlighting diagnostic challenges in this population.

A 63-year-old female with a prolonged cough and blood streaks in sputum, not responding to anti-TB treatment, ultimately diagnosed with lung cancer due to tobacco use.

These cases underscore the need for vigilant monitoring and early intervention in post-cancer individuals vulnerable to latent TB reactivation, comprehensive diagnostic approaches for immunocompromised patients, and heightened awareness of the association between tobacco use and lung cancer. The study emphasizes the importance of thorough assessments, timely interventions, and collaborative efforts among healthcare providers to optimize outcomes in patients with overlapping health concerns.

In conclusion, this study sheds light on the complexities of managing patients with a history of cancer, TB, and tobacco use, advocating for a holistic approach in diagnosis and management to improve patient outcomes and quality of life. Further research and clinical guidelines are warranted to refine treatment strategies and enhance the care of individuals facing these dual health challenges.

Keywords: Lung Cancer, Pulmonary Tuberculosis, Lung Cancer and Pulmonary.

Introduction

Pulmonary tuberculosis (TB) and lung cancer are both significant public health concerns that claim millions of lives annually. Let's research into their relationship and background:

1. Pulmonary Tuberculosis (PTB):

- Pulmonary TB occurs when *Mycobacterium tuberculosis* primarily attacks the lungs. It can also spread to other organs.
- Curability: With early diagnosis and antibiotic treatment, pulmonary TB is curable.
- Historical Context: Pulmonary TB, also known as "consumption," was widespread during the 18th and 19th centuries in North America and Europe⁽⁴⁾.

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2. Lung Cancer:

- Prevalence: Lung cancer is a major cause of cancer-related deaths globally. Approximately 1.76 million people die from lung cancer each year, making it the leading cause of death among men and the third leading cause of cancer in women after breast and colorectal cancer⁽¹⁾.
- Risk Factors: Various risk factors contribute to lung cancer, including smoking, age, gender, and exposure to *Mycobacterium tuberculosis*.
- Hypotheses: The main hypothesis suggests that chronic inflammation caused by *Mycobacterium tuberculosis* promotes lung cancer. Other factors, such as immune system suppression, DNA damage, and inflammatory factor production, may also play a role.
- Cellular and Molecular Mechanisms: While the causal relationship between tuberculosis and lung cancer is widely accepted, recent studies continue to explore the cellular and molecular mechanisms underlying this connection⁽¹⁾.

In summary, understanding the interplay between pulmonary TB and lung cancer is crucial for diagnosis, prevention, and therapeutic approaches⁽⁵⁾. Both diseases impact global health significantly, and ongoing research aims to shed light on their complex relationship^(1,2,3).

Lung cancer is a type of cancer that starts when abnormal cells grow in an uncontrolled way in the lungs. It is the leading cause of cancer-related deaths worldwide⁽⁶⁾. Smoking is the leading cause of lung cancer, responsible for approximately 85% of all cases⁽⁶⁾. Other risk factors include exposure to secondhand smoke, occupational hazards (such as asbestos, radon and certain chemicals), air pollution, hereditary cancer syndromes, and previous chronic lung diseases⁽⁶⁾.

Symptoms of lung cancer include a cough that does not go away, chest pain, and shortness of breath⁽⁶⁾. Lung cancer is often diagnosed at advanced stages when treatment options are limited¹. Early detection through screening high-risk individuals can improve survival rates⁽⁶⁾.

The most common types of lung cancer are non-small cell carcinoma (NSCLC) and small cell carcinoma (SCLC) (1). NSCLC is more common and grows slowly, while SCLC is less common but often grows quickly⁽⁶⁾. Treatments depend on the person's medical history and the stage of the disease⁽⁷⁾. They include surgery, chemotherapy, immunotherapy, radiation, and targeted drugs⁽⁷⁾.

Primary prevention measures such as tobacco control measures and reducing exposure to environmental risk factors can reduce the incidence of lung cancer and save lives⁽⁶⁾. In public health, these preventive measures include smoking cessation, promoting smoke-free environments, implementing tobacco control policies, addressing occupational hazards, and reducing air pollution levels⁽⁶⁾.

Pulmonary tuberculosis is a bacterial infection caused by *Mycobacterium tuberculosis* that primarily affects the lungs⁽⁸⁾. The clinical manifestations of pulmonary TB include cough,

fever, night sweats, weight loss, and hemoptysis (coughing up blood)⁽⁸⁾. The natural history of TB infection is described in detail separately⁽⁸⁾. After primary infection, 90% of individuals with intact immunity control further replication of the bacilli, which may then be cleared or enter a "latent" phase. The person remains asymptomatic, but latent disease has the potential to become active at any time⁽⁸⁾. The remaining 10% of individuals develop progressive primary disease with TB pneumonia and expansion of infiltrates at the site of the initial seeding or near the hilum and may have hilar lymphadenopathy⁽⁸⁾. Individuals with pulmonary involvement may also present with disease at more distant sites, commonly with cervical lymphadenopathy, meningitis, pericarditis, or miliary dissemination⁽⁸⁾.

Progression to local pulmonary disease or dissemination occurs more frequently in those with poor immune responses, such as in those with human immunodeficiency virus (HIV) infection, chronic kidney failure, poorly controlled diabetes mellitus, and in those receiving immunosuppressive medications (including transplant recipients), young children (before the age of five), and older adults⁽⁸⁾. The diagnosis, treatment, and complications of pulmonary TB are discussed separately¹. Treatment for pulmonary TB typically involves a combination of antibiotics for several months⁽⁹⁾. It is important to complete the full course of treatment to prevent the development of antibiotic-resistant strains of TB⁽⁹⁾.

The relationship between pulmonary tuberculosis and lung cancer is a topic of active research. Various investigations have expanded the views that tuberculosis is an important risk factor for lung cancer occurrence⁽¹⁰⁾. Lung cancer originates from chronic inflammation and infection. It is becoming clearer that *Mycobacterium tuberculosis* (M.tb) in tuberculosis patients meticulously schemes multiple mechanisms to induce tumor formation and is indispensable to participate in the occurrence of lung cancer⁽¹⁰⁾. In

addition, some additional factors such as age, sex and smoking, accelerate the development of lung cancer after *Mycobacterium tuberculosis* infection⁽¹⁰⁾.

One study suggests that the chronic inflammation, different produced molecules, genomic changes, and fibrosis in tuberculosis disease are believed to be important factors that may promote carcinogenesis⁽¹¹⁾. As a reverse reaction, the development of carcinogenesis and the treatment may induce the reactivation of latent tuberculosis infection⁽¹¹⁾.

Another study highlights the role of NF-κB signaling in the pathogenesis of tuberculosis and lung cancer⁽¹⁰⁾. Therefore, *Mycobacterium tuberculosis* may promote tumor development through inflammatory factors⁽¹⁰⁾.

Epidemiology of Tuberculosis and Lung Cancer

Epidemiological studies now support a causal relationship between the incidence of tuberculosis (TB) and lung cancer. This evidence provides valuable insights for disease prevention efforts and supports national initiatives aimed at controlling tuberculosis (12). Let's explore into this connection further:

1. Tuberculosis and Lung Cancer Relationship:

- Tuberculosis (TB), caused by *Mycobacterium tuberculosis*, is a significant global health concern. Approximately one-third of people are infected with *Mycobacterium tuberculosis*, and in 2019, 1.4 million people died from TB⁽¹²⁾.
- Lung cancer, on the other hand, is a major cause of cancer-related deaths worldwide. The World Health Organization reports that approximately 1.76 million people die from lung cancer annually⁽¹²⁾.
- Hypotheses linking TB and lung cancer include:
- Chronic inflammation: *Mycobacterium tuberculosis* causes chronic inflammation,

which may promote lung cancer development.

- DNA damage: TB infection can lead to DNA damage, potentially contributing to cancer.
- Inflammatory factors: Mycobacterium tuberculosis produces inflammatory factors that could play a role in lung cancer occurrence.
- Mechanisms: Mycobacterium tuberculosis, as an intracellular organism, can effectively spread through the respiratory pathway. It meticulously schemes multiple mechanisms to induce tumor formation and participates in lung cancer occurrence⁽¹²⁾.
- Additional Factors: Factors such as age, sex, and smoking can accelerate lung cancer development after Mycobacterium tuberculosis infection⁽¹²⁾.

2. Risk Factors Associated with Co-Existence of Pulmonary TB and Lung Cancer:

- Smoking: Smoking is a known risk factor for both TB and lung cancer⁽¹³⁾.
- Age and Gender: These factors also influence the development of lung cancer after Mycobacterium tuberculosis infection.
- Immune Suppression: Mycobacterium tuberculosis infections can suppress the body's innate immune response, potentially elevating the risk of lung cancer⁽¹²⁾.

In summary, understanding the link between TB and lung cancer is crucial for early diagnosis, prevention, and effective management. Researchers continue to explore the cellular and molecular mechanisms underlying this relationship, aiming to improve patient outcomes and reduce the burden of both diseases^(12,13).

Objective

This study aims to investigate the dual challenges posed by tuberculosis reactivation in individuals with a history of cancer treatment and the diagnostic complexities associated with tobacco-related lung cancer.

Through an in-depth analysis of clinical cases, we seek to understand the impact of immunosuppression post-cancer therapy on tuberculosis occurrence and the hurdles in timely diagnosing lung cancer in tobacco users.

The objective is to enhance clinical awareness, promote early detection strategies, and contribute insights for more effective management of these complex medical scenarios.

Case Series

60years male patient history of cough since six months, not responding to antibiotics and symptomatic treatment, past history of pulmonary TB 25 years back taken complete treatment personal history of Bidi smoking more than 30 years on investigation CXR right sided opacity and fibro- cavitary lesions with loculated pleural effusion on RT middle zone, sputum Genxpert test Mycobacterium tuberculosis not detected. HRCT chest gives the diagnosis of suspected Cancer of lung and on Biopsy done, Histopathology gives Adenocarcinoma as the diagnosis, Radiotherapy and Chemotherapy done.

57 years old male patient referred from Cancer hospital, who has completed Chemotherapy and radiotherapy, one year back and having cough for more than 1 month, Genxpert test was done showing Mycobacterium tuberculosis detected with no Rifampicin resistance, and was stated on Anti TB treatment. Patient responded after 15 days and completed the 6 months course.

63 years old female patient, history of cough for 6 months and history of blood streaks sputum 2 months. Anti -TB drugs started 2months and no response. Personal history of chewing tobacco more 30 years. GenXpert test for sputum done Mycobacterium tuberculosis not detected. HRCT

chest suspects CA lung. Biopsy histopathological report shows Ca lung and anti cancer treatment started.

Discussion

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Case 1 cancer in old healed TB lesions

Case 2 after cancer treatment patient immunosuppression TB occur and Last case patient is not diagnosed early

1 and 2 patients are chronic smoker and Last is tobacco chewer.

Conclusion

In conclusion, these cases underscore the intricate challenges presented when managing patients with a history of cancer, tuberculosis, and prolonged tobacco use. Case 1 highlights the vulnerability to latent TB reactivation in post-cancer individuals, emphasizing the importance of monitoring and

early intervention. Case 2 emphasizes the diagnostic hurdles in immunocompromised patients, urging a comprehensive approach for timely identification of both tuberculosis and underlying malignancies. Lastly, Case 3 stresses the significance of recognizing the association between tobacco use and lung cancer, advocating for heightened vigilance in high-risk populations. The study reinforces the need for a nuanced understanding of the interplay between cancer, tuberculosis, and lifestyle factors. It emphasizes the critical role of vigilant screening, thorough diagnostic assessments, and timely interventions to optimize outcomes in patients with complex medical histories. This collective knowledge contributes to a holistic approach in managing individuals with overlapping health concerns, providing valuable insights for clinicians navigating the intricate landscape of post-cancer care, tuberculosis diagnosis, and addressing the impact of tobacco use on respiratory health.

Summary

The study discusses three cases involving patients with a history of cancer, tuberculosis, and tobacco use. Case 1 highlights latent TB reactivation in a post-cancer patient, while Case 2 emphasizes diagnostic challenges in an immunocompromised individual. Case 3 underscores the association between tobacco use and lung cancer. The cases collectively stress the need for comprehensive diagnostic approaches and timely interventions in managing complex clinical scenarios.

Message: Medically Important Message: This study underscores the critical importance of thorough assessments and vigilant monitoring in patients with a history of cancer, tuberculosis, and tobacco use. It highlights the susceptibility to latent TB reactivation post-cancer treatment and the challenges in diagnosing tuberculosis in immunocompromised individuals. Additionally, the study emphasizes the link between prolonged tobacco exposure and lung cancer. Clinicians should adopt a comprehensive approach,

incorporating various diagnostic tools and initiating timely interventions to optimize outcomes in patients with overlapping health concerns.

Prospective message: "Our findings highlight the need for further research and clinical guidelines to optimize the management of lung cancer patients with comorbid tuberculosis. By refining treatment strategies and enhancing collaboration among healthcare providers, we can improve the prognosis and quality of life for individuals facing these dual health challenges."

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