Clinical Case Report

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Pulmonary tuberculosis mimicking radiation pneumonitis in a patient with neck malignancy

A case report

Kyungsoo Bae, MD, PhD[a,b], Kyung Nyeo Jeon, MD, PhD[a,b,*], Hoon Sik Choi, MD[c], Dae Hyun Song, MD[d], Ho Cheol Kim, MD[e]

Abstract

Rationale: Primary or reactivation pulmonary tuberculosis (TB) is frequent in immunocompromised patients such as those with human immunodeficiency virus (HIV) infection, chronic renal failure, poorly controlled diabetes, and hematologic malignancy. Immune system of patients with solid-organ cancer can be also altered by malignancy itself or chemotherapy. However, information on the effect of radiation on patient's immunity is scarce. Herein, we present a case of pulmonary TB occurring in a radiation field that mimics focal radiation pneumonitis in a patient who has received curative chemoradiation therapy for neck malignancy. We also performed literature review to understand the impact of radiation therapy on patients' immunity.

Patient concern: A 56-year-old male patient visited our hospital with a palpable mass in the right supraclavicular fossa which was later confirmed as metastatic squamous cell carcinoma. After completion of concurrent chemoradiation therapy, a focal consolidation was developed in the right upper lobe apex where radiation was applied. The patient did not have any symptoms or signs of infectious disease.

Diagnosis: Pulmonary TB was diagnosed through polymerase chain reaction (PCR) test and culture of sputum.

Intervention: Anti-TB medication was started.

Outcome: The patient was tolerable to anti-TB medication and the size of TB lesion gradually decreased.

Lesson: A suspicion of pulmonary TB should be given to patients with new infiltrates in radiation port due to impact of radiation therapy on local infection barriers and patients' immune system.

Abbreviations: CCRT = concurrent chemoradiotherapy, CT = computed tomography, TB = tuberculosis.

Keywords: chemotherapy, latent tuberculosis, pneumonitis, radiotherapy, tuberculosis

1. Introduction

Although there have been controversies about the relationship between non-hematologic malignancies and development of active pulmonary tuberculosis (TB), recent studies have shown an increased risk of active pulmonary TB in patients receiving anticancer chemotherapy, particularly when patients have latent TB.[1,2] However, little is known about the effect of radiation therapy on the development of active pulmonary TB in patients with solid-organ cancer. Herein, we present a case of primary pulmonary TB mimicking radiation pneumonitis in a patient after undergoing concurrent chemoradiation therapy for neck malignancy.

2. Case report

The Ethical Committee of Gyeongsang National University Changwon Hospital approved this study (approval no.: 201902011). The patient provided written consent for publication of this case. A 56-year-old male patient visited our hospital with a palpable mass on the right neck for 2 months. The patient did not complain of any pain or tenderness over the mass. He was previously healthy without any medical illness. His family history was not significant for malignancy or TB either. He had never smoked before. On neck and chest computed tomography (CT) scans, a mass of about 5.3 cm in size was found in the right supraclavicular fossa (Fig. 1A). Other parts of the neck or chest were unremarkable. Sputum examination for *Mycobacterium tuberculosis* was negative. Because fine needle aspiration biopsy of the mass was inconclusive, the patient underwent incisional

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This study was approved by the Institutional Review Board of Gyeongsang National University Changwon Hospital.

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[a] Department of Radiology, Institute of Health Sciences, Gyeongsang National University School of Medicine, Jinju, [b] Department of Radiology, [c] Department of Radiation Oncology, Gyeongsang National University Changwon Hospital, Changwon, [d] Department of Pathology, [e] Department of Internal Medicine, Gyeongsang National University School of Medicine, Jinju, Korea.

[*] Correspondence: Kyung Nyeo Jeon, Department of Radiology, Gyeongsang National University School of Medicine, Jinju, Gyeongsang National University Changwon Hospital, 555 Samjeongja-dong, Seongsan-gu, Changwon, 51472, Korea (e-mail: knjeon@gnu.ac.kr).

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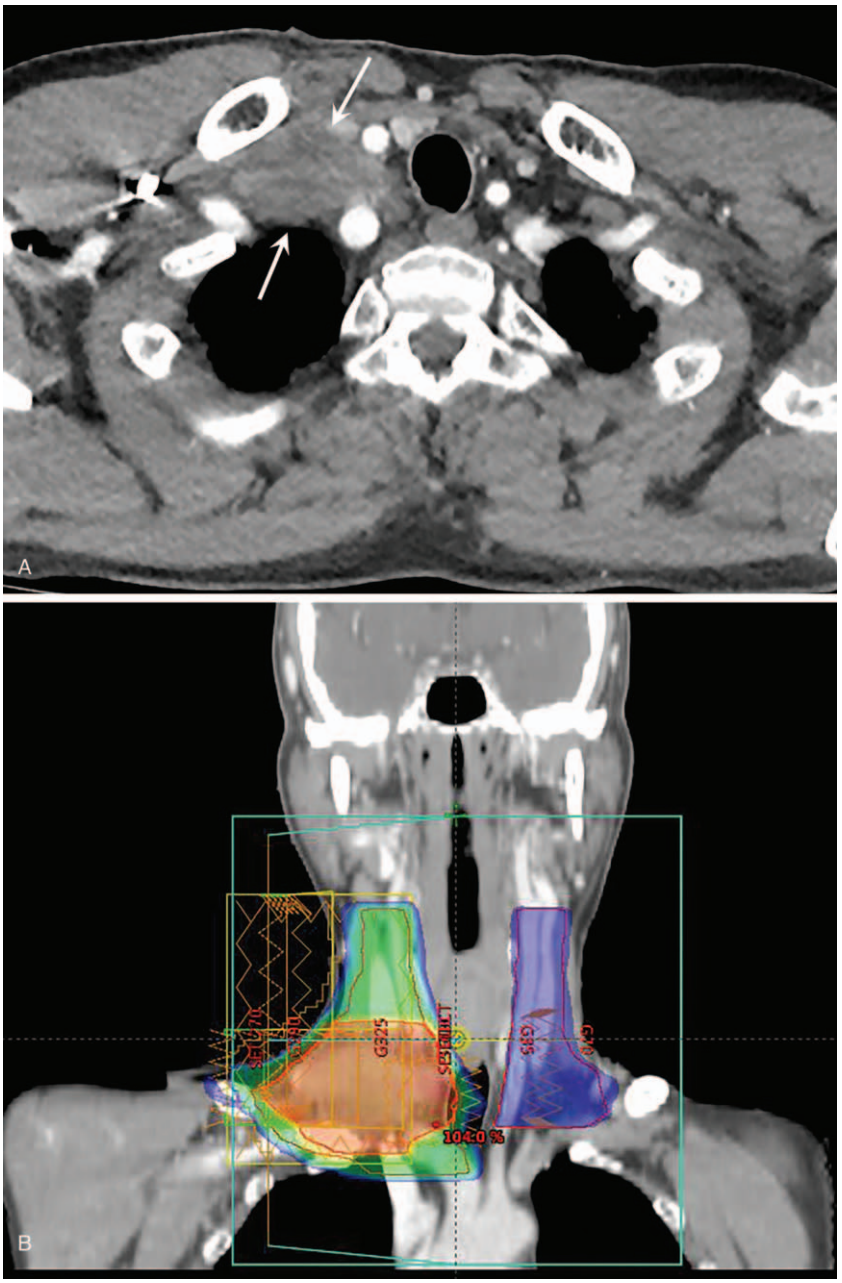

Figure 1. A. Contrast enhanced chest CT obtained at the level of thoracic inlet showing a conglomerate mass in the right supraclavicular fossa (arrows) later confirmed as metastatic squamous cell carcinoma. B. Dose distribution at radiation planning simulation. Note that the right lung apex is involved in the radiation area with >75% of the total dose. CT = computed tomography.

biopsy of the mass. On pathologic examination of the specimen, well-differentiated, metastatic squamous cell carcinoma was suggested. Since examinations including whole-Body 18F-FDG PET/CT were unremarkable except for the neck mass, the patient was diagnosed as metastatic squamous cell carcinoma with an unknown primary site.

The patient received curative concurrent chemoradiotherapy (CCRT). Radiation therapy was applied to the right neck mass and potential mucosal sites with the following doses: a total of 7000 cGy on the mass, 6000 cGy on the right neck, and 5000 cGy on the left neck over 35 fractions (Fig. 1B). Simultaneously, he received chemotherapy with cisplatin (50 mg i.v.) weekly. During radiation therapy, the patient suffered from radiation-induced dermatitis over the mass. Follow-up CT scans of the neck and chest obtained at 3 months after completion of CCRT showed extensive internal necrosis of the mass with slight increase in size (Fig. 2A). Inferior aspect of the mass showed infiltration into adjacent lung. In addition, a focal consolidation was found at the posterior aspect of the mass in the right upper lobe which was included in radiation field. Lateral margin of the consolidation showed a sharp border between involved lung and normal lung following borders of radiation port (Fig. 2B and C). Although the patient did not have fever or other signs of infection, pneumonia and pulmonary TB were included in differential diagnosis.

Figure 2. A. Follow-up chest CT scan at 3 months after radiation therapy showing extensive necrosis of the right supraclavicular mass. B. Chest CT with lung window setting showing a newly developed consolidation in the right upper lobe apex. Note sharply demarcated lateral margin conforming to the radiation port. C. Sagittal plane showing the relationship between the mass (asterisks) and new consolidation (arrows). CT = computed tomography.

However, sputum study for bacteria or acid-fast bacilli was negative. Therefore, radiation pneumonitis occurring in apical lung secondary to lower neck radiation was suspected. The lesion was followed up without any specific treatment.

On serial chest X-rays, consolidation in the right upper lobe gradually increased. Eventual cavity formation was noted. Chest CT scan obtained 20 days later showed thick-walled cavity and satellite nodules in adjacent area, suggesting necrotic infection with bronchogenic spread (Fig. 3). Through polymerase chain reaction (PCR) test and culture of sputum, *M tuberculosis* was identified. Anti-TB medication was immediately started. The patient was tolerable to anti-TB medication. During follow-up of 4 months after starting the anti-TB medication, the size of the cavity gradually decreased.

3. Discussion

Diagnosis and management of pulmonary TB in compromised host remain challenging in recent years. Patients with solid-organ cancer can be susceptible to infection due to altered immunity by malignancy itself or anticancer treatment.[2–5] Our patient had a squamous cell carcinoma in the right neck. In a large-scale retrospective cohort study, the risk of pulmonary TB is increased in the group with head and neck cancer compared to that in the general population.[6] Anti-cancer treatment can increase the hazard of pulmonary TB from 1.26 to 3.73.[6] Long-term continuous systemic chemotherapy can result in significant immune suppressions in patients with cancer.[7–9] Patients undergoing long-term chemotherapy are known to have higher risks of TB and fatality or complication of TB than patients without cancer.[5,8,10,11] Cyclic anti-cancer chemotherapy does not cause significant immune suppression, particularly in patients with head and neck cancer.[8,12]

Radiation therapy was the mainstay of cancer treatment in the present case. A total radiation dose of 18,000 cGy was applied to the mass and neck area. Cisplatin was used on a weekly basis to potentiate the effect of radiation therapy. Little is known about the effect of radiation therapy on patients' immunity and risk of pulmonary TB.[13,14] It is commonly thought that radiation therapy only has local effect on cancer and adjacent normal tissues by directly damaging deoxyribonucleic acids (DNAs) of cells and destroying local infection barriers. However, some studies have shown that radiation therapy also has systemic effect.[14,15] Radiation therapy can also cause lymphopenia and alter the balance of immune cells.[15] Total lymphocytes count remains significantly low in patients who undergo radiation therapy up to several years. Among lymphocytes, decline of B- and T-cells are severe while that of granulocytes is minimal.[15] Reactivation of pulmonary TB has been reported in a patient following 3 months of high-dose radiation therapy for prostate cancer.[14] Since cell-mediated immunity is particularly important

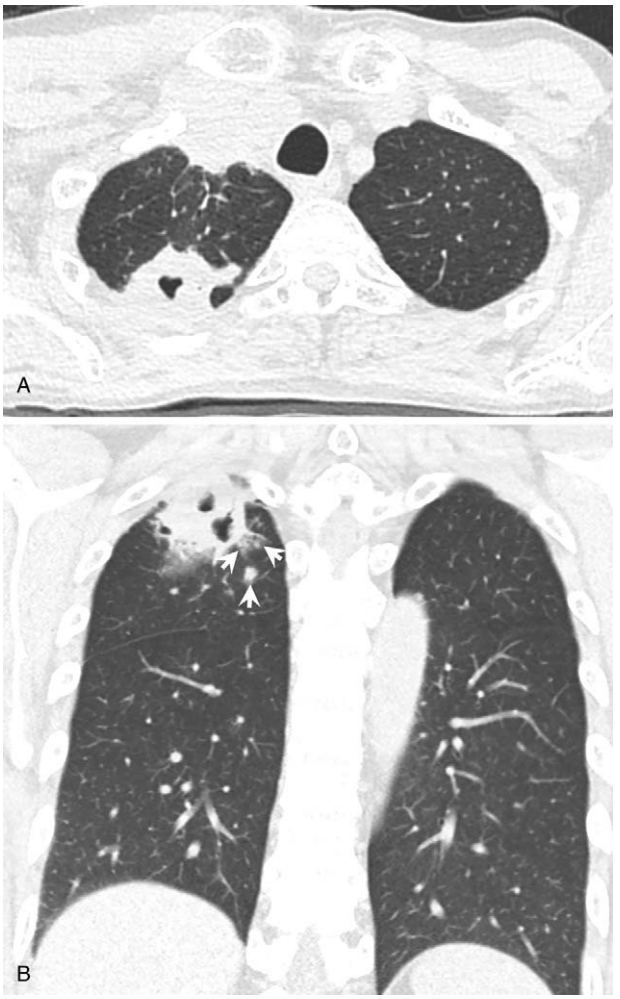

Figure 3. A. Follow-up chest CT obtained 20 days later showing cavity formation in the consolidation. B. Coronal reformatted CT image showing a cavitary lesion and adjacent satellite nodules with tree-in-bud appearance (arrows) suggestive of bronchogenic dissemination of infection. CT= computed tomography.

in preventing TB infection, high dose radiation therapy can be a risk factor of active pulmonary TB.[16]

Radiation pneumonitis is an important side effect of radiation therapy. It typically occurs at 1 to 6 months after completing the therapy. Radiation pneumonitis involves the lung area affected by radiation dose above 30 to 40 Gy. In chest CT, radiation pneumonitis appears patchy or discrete consolidation that conforms to the shape of radiation port, showing a sharp border between involved lung and normal lung.[13] Diagnosis of radiation pneumonitis can be made when compatible imaging findings are shown after excluding infectious causes. CT features of pulmonary TB may vary. Airspace consolidation of varying degrees, cavitation, and centrilobular nodules with tree-in-bud appearance are common findings of post-primary TB in adults.[17] In the present case, new infiltrates that conformed to the radiation port in the absence of latent TB and signs of infection caused confusion in the diagnosis of pulmonary TB.

In conclusion, a suspicion of pulmonary TB should be given to patients with new infiltrates in radiation port due to impact of radiation therapy on local infection barriers and patients' immune system.

Author contributions

Conceptualization: Kyungsoo Bae.
Data curation: Hoon Sik Choi, Ho Cheol Kim.
Formal analysis: Kyung Nyeo Jeon.
Investigation: Hoon Sik Choi.
Methodology: Hoon Sik Choi.
Resources: Dae Hyun Song, Ho Cheol Kim.
Supervision: Kyung Nyeo Jeon.
Writing – original draft: Kyungsoo Bae.
Writing – review & editing: Kyung Nyeo Jeon, Dae Hyun Song, Ho Cheol Kim.

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