levels that pose a threat to public health. OSHA collected 40 samples from the disaster site and found no hazardous levels of silica. The highest level was less than half the OSHA limit. To our knowledge, inhalation of silica and asbestos have not been associated with granulomatous reactions in the lung. Fine particulate matter (up to 2.5 μm in diameter) measured by continuous monitors and consisting mostly of combustion fuels were < 65 μg/m³, but rapidly fell to < 40 μg/m³ after 3 days. No amphibole asbestos was detected. Chemical leach tests and infrared imaging spectroscopy demonstrated the presence of heavy metals and metalloids such as aluminum, chromium, antimony, and barium.

Because we were able to exclude common causes of granulomatous pneumonitis such as berylliosis, sarcoidosis, tuberculosis, extrinsic allergic alveolitis due to organic dusts, and other bacterial, fungal, and viral illnesses, we suspect that exposure to dust at the WTC accounted for his illness. His illness may have been due to the inhalation of heavy metals based on air-sampling studies in the first 48 h following the explosion. It is quite possible because of the many chemicals, both organic and inorganic, released into the air that a totally unknown etiologic factor produced these granulomatous reactions.

CONCLUSION

Physicians who care for patients who were exposed to the dust caused by the collapse of the WTC towers or who continue to work in its midst with or without respiratory protection should be alerted to the possibility of hypersensitivity pneumonitis as an aftermath of the exposure. This case report should promote additional research in determining what environmental agents trigger sarcoid-like reactions. The opportunity to identify additional cases may provide clues as to the cause of sarcoidosis in some individuals.

REFERENCES


Squamous Cell Lung Cancer Simulating an Acute Myocardial Infarction*

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Lung cancer involvement of the heart is silent, carries a poor prognosis, and is most commonly identified at autopsy. A patient with lung cancer presented with symptoms and ECG findings suggestive of an acute coronary syndrome. Persistent symptoms and normal creatine phosphokinase (CPK) levels led to use of MRI and radionuclide scintigraphy to diagnose neoplastic infiltration of the myocardium. Palliative care was established with significant symptom relief. Assessment for cardiac metastases should be considered in patients with advanced lung cancer presenting with chest pain, new ECG findings, and normal CPK levels.

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Key words: cardiac enzymes; cardiac metastases; lung cancer; MRI; myocardial infarction; NeoTect radioisocintigraphy; radionuclide imaging

Abbreviation: CPK = creatine phosphokinase

Neoplastic involvement of the heart occurs insidiously in patients with advanced lung cancer and is rarely recognized prior to autopsy. A patient with lung cancer presenting with signs and symptoms suggestive of an acute coronary syndrome was found to have cardiac metastases with the use of thoracic MRI and radionuclide scintigraphy.

CASE REPORT

A 54-year-old man with stage IIIA squamous cell lung cancer treated with radiation therapy arrived at the emergency department reporting dyspnea and dull precordial chest pain radiating to the shoulder. This new-onset chest pain was aggravated with exertion but not reproducible with coughing or movement. Physical examination was noted to be unremarkable.

ECG demonstrated a prior inferior wall injury pattern and new pronounced ST-segment elevation in the precordial leads (Fig 1).

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A chest radiograph demonstrated a previously described 6-cm left upper lobe mass. Serum creatine phosphokinase (CPK) levels were within normal limits. Despite antianginal treatment, the symptoms persisted and treatment for an acute myocardial infarction was initiated with streptokinase, heparin, and aspirin. Subsequently, the patient was transferred to a tertiary care ICU.

On arrival, he reported partial relief of his symptoms. Vital signs included BP of 110/60 mm Hg; pulse, 95 beats/min; respirations, 20 breaths/min; pulse oximetric saturation, 100% on 2 L of oxygen. Breath sounds were diminished over the left upper lung field. A pericardial rub was detected, and pulsus paradoxus was absent. Serial ECG findings were unchanged, and CPK levels remained within normal limits. The initial serum troponin I level was elevated, and at 48 h had declined to normal limits.

Despite treatment for ischemic heart disease, the patient reported persistent chest pain and palpitations. Evaluation of symptoms with an echocardiogram revealed normal wall motion and thickening of the pericardium. Thoracic MRI demonstrated a lung mass impinging on the pericardium and involving the myocardium (Fig 2). A 99mTc depreotide radionuclide scan (NeoTect; Diatide Research Laboratories; Londonderry, NH) demonstrated increased uptake in the left upper lobe corresponding with the primary tumor and a smaller cardiac lesion consistent with metastatic disease (Fig 3). The patient informed of these findings, prescribed narcotic analgesics and anxiolytics, and treatment for ischemic heart disease was discontinued. He was released to hospice care with improved pain control and no clinical evidence of myocardial ischemia.

**Discussion**

Lung cancer involvement of the heart is silent, carries a poor prognosis, and is most commonly identified on autopsy. Advanced lung cancer is a leading factor in the development of cardiac metastases. Cardiac involvement may also be observed with lymphoma, leukemia, melanoma, and tumors of the breast, colon, stomach, and liver. Cardiac involvement appears to be related to the histologic cell type, degree of tumor cell differentiation, and extent of disease. Proposed mechanisms for involvement of the pericardium and myocardium include direct invasion, retrograde lymphatic extension, hematogenous seeding, and transvenous infiltration.

Antemortem diagnosis of cardiac metastases is challenging due to the nonspecific nature of the clinical findings. Symptoms may include cough, chest pain, dyspnea, and palpitations. Physical findings may include a pericardial friction rub or pulsus paradoxus. ECG findings may

![Figure 1](image1.png) **Figure 1. Initial ECG revealing prominent ST-segment elevation in the precordial leads and prior inferior wall injury pattern.**

![Figure 2](image2.png) **Figure 2. Thoracic MRI demonstrating tumor infiltration of the myocardium as indicated by the arrow. Specifically, the apical portion surrounding the left (L) ventricle and septal region separating the right (R) and left ventricles were noted to be involved.**

![Figure 3](image3.png) **Figure 3. 99mTc depreotide image reveals increased radiotracer uptake in the left upper lobe mass (*) that represents squamous cell lung cancer. An arrow indicates the area of increased uptake at the apical portion of the cardiac silhouette representing metastatic involvement of the heart.**
demonstrate regional ST-segment elevation or T-wave inversion, and these may occur in the presence or absence of symptoms. Serum CPK levels have been reported to be within the normal range in patients with myocardial metastases. Elevated troponin levels may be observed with pericarditis. Proposed mechanisms for elevated cardiac enzymes include direct myocardial invasion, coronary artery compression, tumor embolization, or pericarditis. We speculate that in the present case thrombolytic administration in the setting of unrecognized cardiac metastases aggravated the pericardial process resulting in elevated serum troponin levels.

Echocardiography provides a rapid evaluation of the size, location, and hemodynamic effects. When echocardiographic findings are nondiagnostic, CT or MRI provide a view of the pulmonary parenchyma, pleura, mediastium, and cardiac vessels and may offer insight to the origin of the tumor. Radionuclide scintigraphy has been utilized to evaluate solitary pulmonary nodules and suspected cardiac metastases. In contrast, fluorine-18 fluorodeoxyglucose positron emission tomography has been employed for noninvasive evaluation of solitary pulmonary nodules with reported positive and negative predictive values of 87% and 93%, respectively, but it has not been utilized to assess for cardiac metastases. In summary, cardiac metastases are a sign of an advanced stage of lung cancer and are frequently unrecognized prior to postmortem examination. Diagnostic evaluation using MRI and radionuclide imaging are useful to assess for neoplastic infiltration of the heart.

CONCLUSION

Assessment for cardiac metastases should be considered in patients with advanced lung cancer presenting with chest pain, new ECG findings, and normal serum CPK levels.

REFERENCES