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Silent Neoplastic Cardiac Invasion in Small Cell Lung Cancer: A Case Report and Review of the Literature

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
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Patient: Female, 66
Final Diagnosis: Small cell lung cancer
Symptoms: Impaired memory
Medication: —
Clinical Procedure: Chest X-ray • computed tomography • magnetic resonance imaging • electrocardiogram
Specialty: Oncology

Objective: Rare co-existence of disease or pathology
Background: Secondary malignant tumor of the heart is one of the most life-threatening complications of lung cancer. Several published case reports have documented non-small cell lung cancer (NSCLC) patients with neoplastic cardiac invasion. However, the number of reported cases of small cell lung cancer (SCLC) with neoplastic cardiac invasion is limited.
Case Report: We present a rare case of advanced SCLC in a patient with asymptomatic neoplastic cardiac invasion. We also discuss radiation therapy modalities that should be considered in SCLC patients with cardiac invasion.
Conclusions: Clinicians should be vigilant about cases of SCLC with asymptomatic intra-cardiac invasion and practice caution when diagnosing, as well as treating with radiation as a monotherapy.

MeSH Keywords: Lung Neoplasms • Neoplasm Metastasis • Radiation • Small Cell Lung Carcinoma

Full-text PDF: <https://www.amjcaserep.com/abstract/index/idArt/908374>

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Background

Neoplastic cardiac invasion is one of the morbid complications of lung cancer. Autopsy reports have demonstrated that up to 7% of all cancer cases have cardiac metastases and up to 10% of bronchogenic tumors have atrial invasion [1]. However, the literature shows limited reports of small cell lung cancer (SCLC) patients with neoplastic cardiac invasion [2–7]. In addition to cardiac invasion, brain metastasis is another fatal complication that occurs in up to 70% of SCLC patients with advanced disease [8]. Some of the tumor- and treatment-related symptoms in these cases include dysregulated secretion of antidiuretic hormone, peripheral neuropathy, and encephalopathy.

A significant proportion of SCLC patients with cardiac metastases have atrial invasion, which may lead to systemic embolization and/or outflow obstruction [9,10]. In such cases, aggressive local treatment is important regardless of overall prognosis. Given the life-threatening nature of the disease, the current criterion standard treatment for neoplastic cardiac invasion is surgical resection. However, treatment decision is complicated when the patient is not a suitable candidate for surgery due to comorbidities (e., thrombocytopenia, refractory diabetes, and poor pulmonary function) or performance status. In such cases, radiotherapy is an alternative local treatment option. Recent studies reported the use of radiotherapy in non-small cell lung cancer (NSCLC) invaded into the heart [1,2]. Treatment outcomes were very promising and treatment-related cardiac complications are not common. Despite these favorable outcomes in NSCLC, there are only limited reports on the use of high-dose radiotherapy as the definitive monotherapy for cardiac invasive tumors from SCLC. Tumor

cells in SCLC are responsive to chemotherapy and radiotherapy. In our experience, we often observed tumor shrinkage on cone beam computed tomography shortly after the initiation of radiation therapy. One of the challenges, however, is the uncertainty of how radiation therapy will affect the structure and function of the heart after the tumor is treated. Here, we present a rare case of asymptomatic cardiac invasion from lung cancer in a patient with stage IV SCLC. We also discuss radiation therapy modalities that should be considered in SCLC patients with cardiac invasion.

Case Report

A 66-year-old woman with a 30-pack-year smoking history presented to the Emergency Department for cognitive impairment with memory loss. On admission, she received a chest X-ray that showed a large left lung mass. A follow-up chest computed tomography (CT) and magnetic resonance imaging (MRI) tests showed a 7.7×8.5×7.4 cm necrotic mass arising from the right lower lobe to invade the left atrium via the inferior left pulmonary vein and extend into the left ventricle (Figure 1). On electrocardiogram (ECG), there was also evidence of the left atrial mass prolapsing through the mitral annulus with partial mitral valve obstruction. The ECG reports showed normal sinus rhythm, and routine laboratory tests, including metabolic panel and complete blood count, were normal with the exception of low platelet count (120 000 per microliter). Further work-up with MRI brain, in the presence or absence of contrast, revealed a 4.5×2.8×3.2 cm hemorrhagic temporal occipital lesion. Subsequently, the patient received craniotomy with gross total resection of the brain tumor and

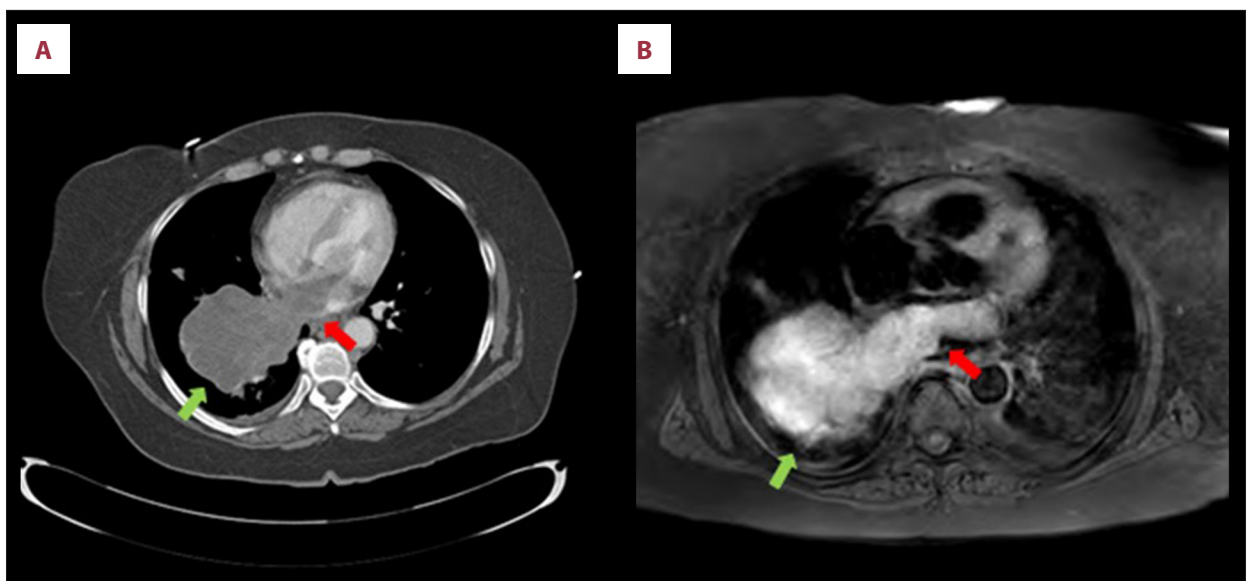


Figure 1. CT scan (A) and MRI (B) of the chest showing a pulmonary vein and left atrial tumor invasion (red arrows) and right lower lobe primary tumor (green arrows).

the pathology report revealed poorly differentiated carcinoma with immunohistochemical stains confirming strongly reactive tumor cells for CD56, consistent with neuroendocrine differentiation. In addition, bronchoscopy-based biopsy of the right lower lung lobe confirmed similar pathology to that of the brain specimen. Accordingly, she was diagnosed with stage IV, T4NxM1, SCLC of the right lower lung lobe. The post-operative course was significant for worsening thrombocytopenia with a sharp drop in platelet count to as low as 19 000 per microliter. Thoracic surgery and medical oncology teams recommended against surgery or chemotherapy. The radiation oncology team was further consulted for treatment options and offered a course of palliative radiotherapy treatment to the thorax and whole brain. Unfortunately, the patient died of an unknown cause before the planned radiotherapy regimen could be delivered. At the family's request, an autopsy was not performed.

Discussion

Here, we report a case of asymptomatic neoplastic cardiac invasion in a patient with stage IV SCLC. This report is in line with the limited number of SCLC cases that involved intra-cardiac invasion [3–7]. However, our patient, despite being stage IV SCLC, showed no symptoms of cardiac invasion and her ECG was normal. The pathogenesis of cardiac invasion in SCLC is thought to be hematologic or lymphatic spread, or direct invasion from a nearby tumor. Due to fatal outcomes of intra-atrial tumors, the standard treatment of choice in such cases is complete *en bloc* resection of the primary tumor and left atrium with or without the great vessels [1]. However, when a patient does not qualify for surgery, as in this case, there is a compelling need for alternate treatment such as radiotherapy.

The use of radiation as the local monotherapy for cardiac lesions is currently underutilized, even for non-surgical patients, primarily due to the concern of radiation-induced heart disease (RIHD), which is a relatively common complication when the heart receives a large dose of radiation [11]. At doses above 30 Gy, RIHD may become apparent within the first 2 years of exposure and the risk increases, with accelerated manifestations, at higher radiation doses. High-dose irradiation of a large volume of the heart can seriously damage vital components of the heart, including the valves, arteries, and conducting systems. Acutely, the pericardium may be severely inflamed

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(pericarditis), while the long-term complications include cardiac fibrosis and coronary artery disease. Collectively, these complications are responsible for significant cardiovascular morbidity and mortality, particularly in patients with underlying major adverse cardiovascular events.

Modern radiation oncology techniques, such as intensity-modulated radiotherapy (IMRT) or stereotactic body radiotherapy (SBRT), can overcome the aforementioned risks by substantially reducing the radiation dose to the heart. The increased accuracy and precision of contemporary radiotherapy treatment planning algorithm and technology allows for a sharp dose fall-off to the normal heart and a smaller margin used for daily set-up error and internal organ motion. In particular, strategies such as deep inspiratory breath hold [12] or respiratory gating [13] can significantly reduce the risk of pericardial disease and coronary artery disease. Lee et al. recently employed IMRT to deliver 50 Gy in 20 fractions to the metastatic cardiac lesion from NSCLC, with the maximum dose to the intra-atrial lesion reaching 55.8 Gy and a mean dose of 23 Gy to the uninvolved heart [1]. The patient had no acute complications from radiation, and in fact had complete resolution of her intra-cardiac disease within 3 months. Similarly, Li et al. reported the use of SBRT to deliver a 40 Gy total dose in 10 fractions for an atrial tumor thrombus from NSCLC [2]. A complete response was achieved within 12 months and no cardiac toxicity was noted. A study by Orcurto et al. reported a right heart metastasis from a small cell lung cancer [5]. The patient was treated with chemotherapy (6 cycles of cisplatin and etoposide) followed by radiotherapy (total dose of 60 Gy) to the lung mass, nodes, and cardiac metastasis. Radiation treatment technique and fractionation schedule was not discussed in the paper. Patient had complete response on restaging PET/CT at 2 months.

The positive outcomes of these recent reports suggest that radiation can be safely used to treat neoplastic involvement of the atria. Regrettably, our patient died before treatment could be delivered.

Conclusions

Clinicians should be vigilant about cases of SCLC with asymptomatic intra-cardiac invasion and practice caution when diagnosing, as well as treating with radiation as a monotherapy.

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