Case Report

A Rare Presentation of Lung Carcinoma: Cardiac Metastasis With Left Atrial Involvement Through the Pulmonary Veins

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ABSTRACT

Lung cancers can extend along or grow through the pulmonary veins to invade the left atrium. A 51-year-old man, previously healthy, presented with left-sided chest pain, dry cough, and dyspnea of 2 months' duration. The patient also had a history of weight loss and decreased appetite. On physical examination, he had tachycardia and tachypnea. Cardiac examination revealed normal heart sounds and no murmurs. Auscultation of the chest revealed diminished breath sounds in the left hemithorax. Chest radiography showed a left-sided massive pleural effusion. A computed tomography scan confirmed the radiographic findings with a mass extending along the pulmonary vein into the left atrium, suggestive of tumor thrombosis. Transthoracic and transesophageal echocardiographic examinations revealed a mass within the left atrium, measuring about 1.9×1.6 cm at its largest diameter. This case report has 2 primary justifications, considering the rarity and the poor outcome.
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KEYWORDS: Lung cancer, Pulmonary vein, Tumor thrombosis, Left atrial metastasis

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Lung malignancies can extend in various directions; nonetheless, encroachment into the left atrium is a rarely reported phenomenon. Cytokines, which can be produced by cancer cells, also play an important role in tumor growth, local invasion, and distant metastasis. Malignant cells can involve the pulmonary veins, either through lung capillaries or direct extension, and invade the left atrium. Tumors that directly invade the left atrium belong to T4 of the TNM classification, suggesting that the tumor is inoperable. Tumor extension to the left atrium through the pulmonary veins is rarely reported in the literature.

Case Report

A 51-year-old man presented with complaints of left-sided chest pain of 2 months' duration. The patient had a decreased appetite and significant weight loss. He had smoked about 1 pack of cigarettes every day for the past 15 years. He was nil premorbid and was not on any medications. No significant family history was reported. On general physical examination, he had grade III clubbing. His vital signs showed tachycardia (heart rate =118 beats/min) and tachypnea (respiratory rate =28 cycles/minute). His blood pressure was 130/80 mm Hg with no postural drops. He had a normal room air saturation level of

98%. Cardiac examination revealed normal heart sounds. Pulmonary auscultation demonstrated diminished breath sounds in the left hemithorax. His blood reports revealed hemoglobin of 13.7g% and total counts of 7400/uL. He had an elevated erythrocyte sedimentation rate of 28 mm/h. Other blood parameters like renal function and liver function tests were within normal limits. His chest X-ray showed a left-sided massive pleural effusion (Fig. 1). Computed tomography (CT) thorax showed a mass lesion measuring about 7.5×5.5 cm with irregular margins in the left lower lobe with an adjacent collapse consolidation of the underlying lung and a left-sided gross pleural effusion (Fig. 2A & Fig. 2B). A soft tissue density mass measuring 1.9×1.6 cm in the left atrium suggestive of tumor thrombosis was noted (Fig. 3A & Fig. 3B). There was infiltration in the left pulmonary artery and the left bronchus with severe narrowing in the distal segment (Fig. 2A, Fig. 2B & Fig. 4, respectively). Electrocardiography (ECG) showed normal sinus rhythm. Transthoracic echocardiography revealed a moderately dilated left atrium with a spherical echogenic, heterogeneous mass originating from the left upper pulmonary vein obstructing almost 100% of blood flow, which was confirmed by transesophageal echocardiography (Fig. 5, Fig. 6, Video 1, Video 2 & Video 3). The features were suggestive of tumor thrombosis. Pleural fluid analysis showed a lymphocytic predominance with an exudative nature. The pleural fluid adenosine deaminase (ADA) and lactate hydrogenase (LDH) levels were 4 and 130, respectively. Acid-fast bacillus (AFB), Gram stain, and cultures came back negative.

The patient underwent a CT-guided biopsy, which revealed the lung malignancy to be a poorly differentiated adenocarcinoma. In the setting of metastatic left atrial invasion, the patient was offered conservative management with chemotherapy and supportive care. However, later, he was lost to follow-up. He was started on anticoagulation with heparin in the hospital and later transitioned to oral anticoagulation. He was advised to pursue follow-ups with the oncology department and was discharged in a stable condition.

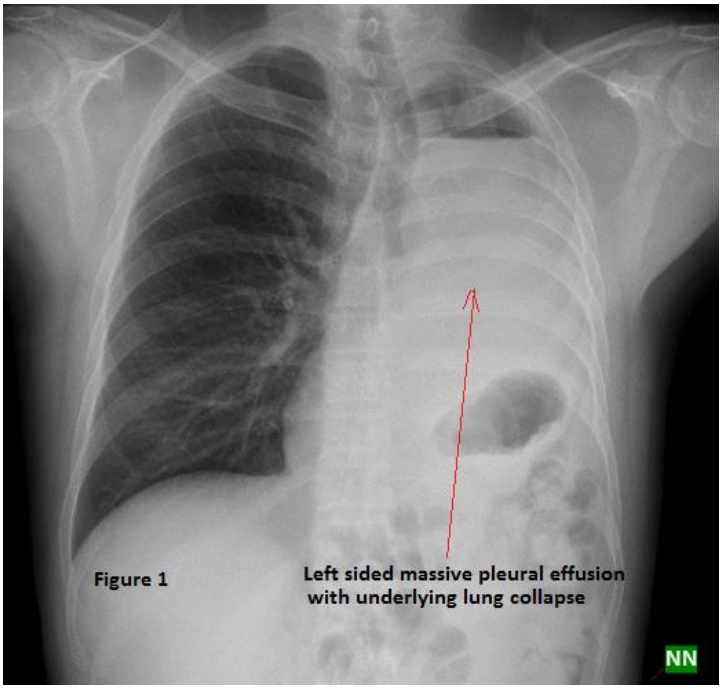
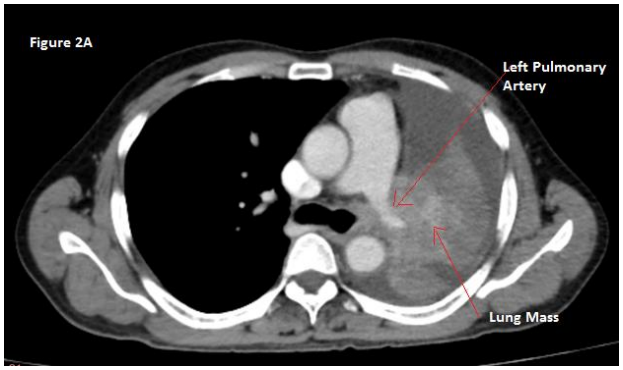
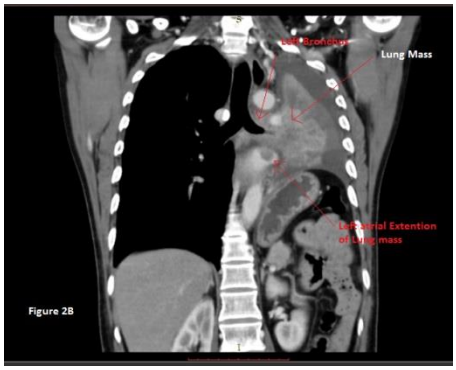
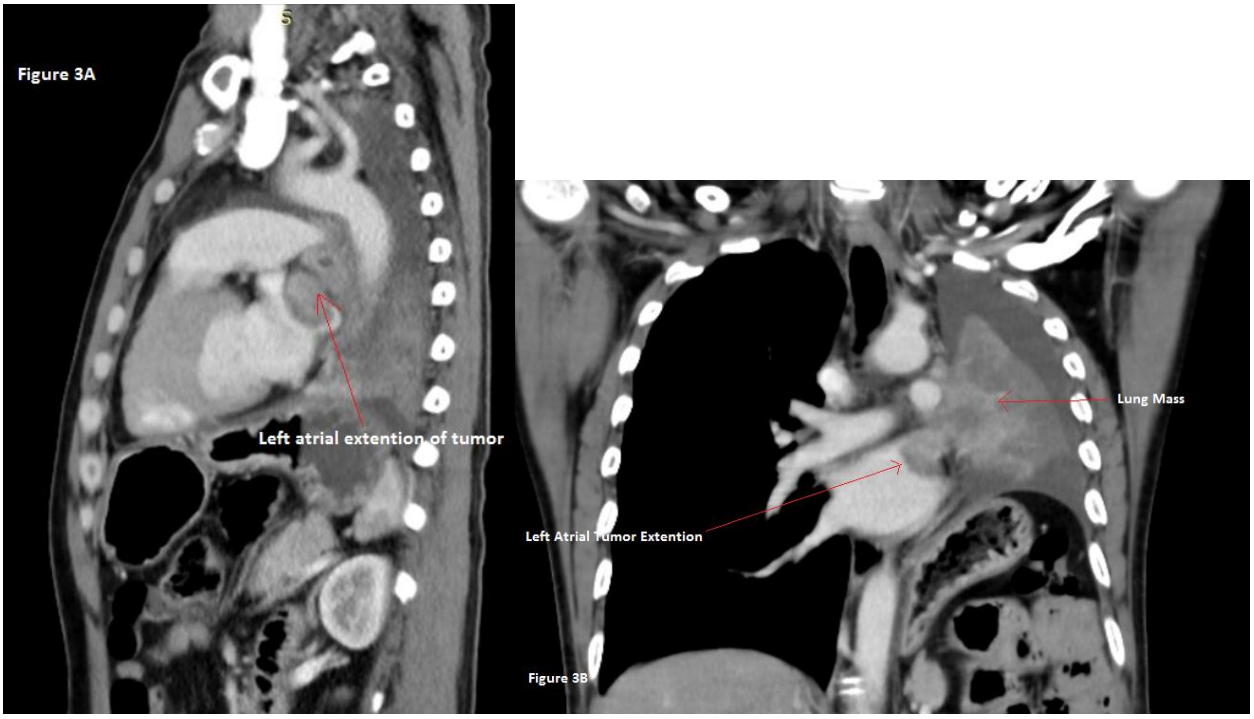


Figure 1. The chest X-ray shows a left-sided massive pleural effusion with an underlying lung collapse.





Figures 2A and 2B. The computed tomography thorax shows a mass lesion measuring about 7.5x5.5 cm with irregular margins in the left lower lobe with an adjacent collapse consolidation of the underlying lung and a left-sided gross pleural effusion. There is infiltration in the left pulmonary artery and the left bronchus with severe narrowing in the distal segment.



Figures 3A and 3B. The computed tomography thorax shows a soft tissue density mass measuring 1.9x1.6 cm in the left atrium, suggestive of tumor thrombosis.

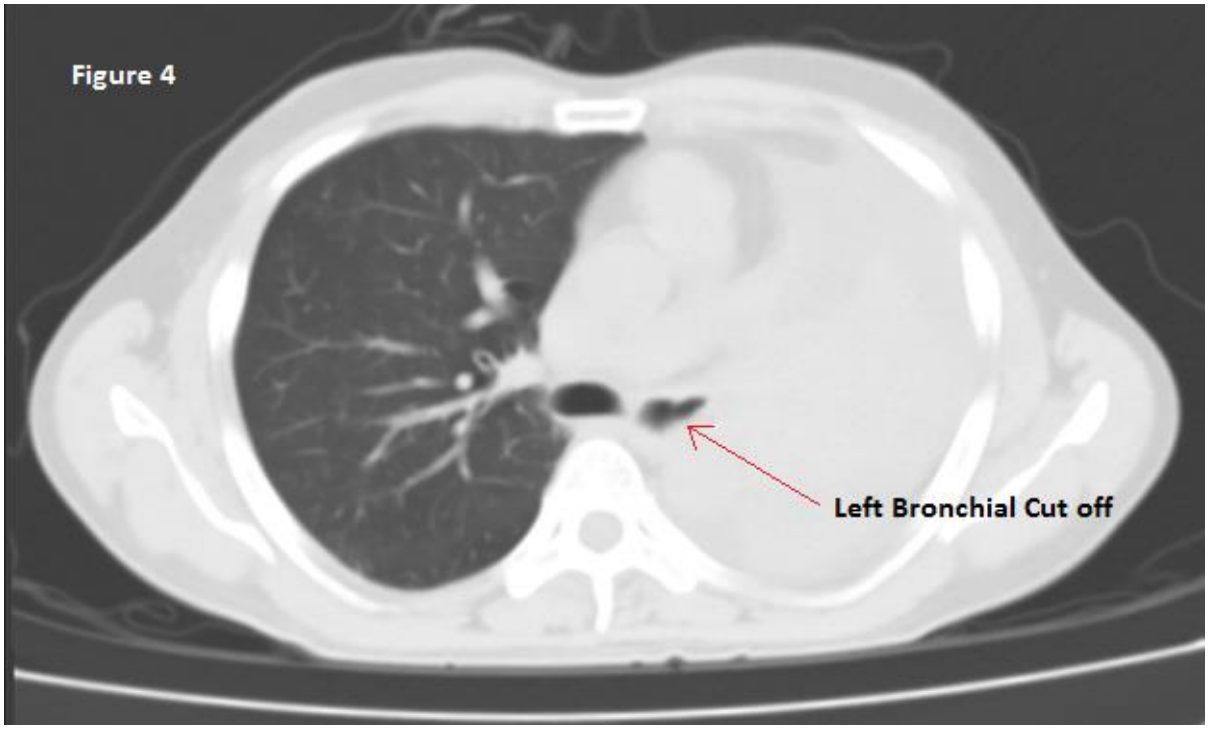
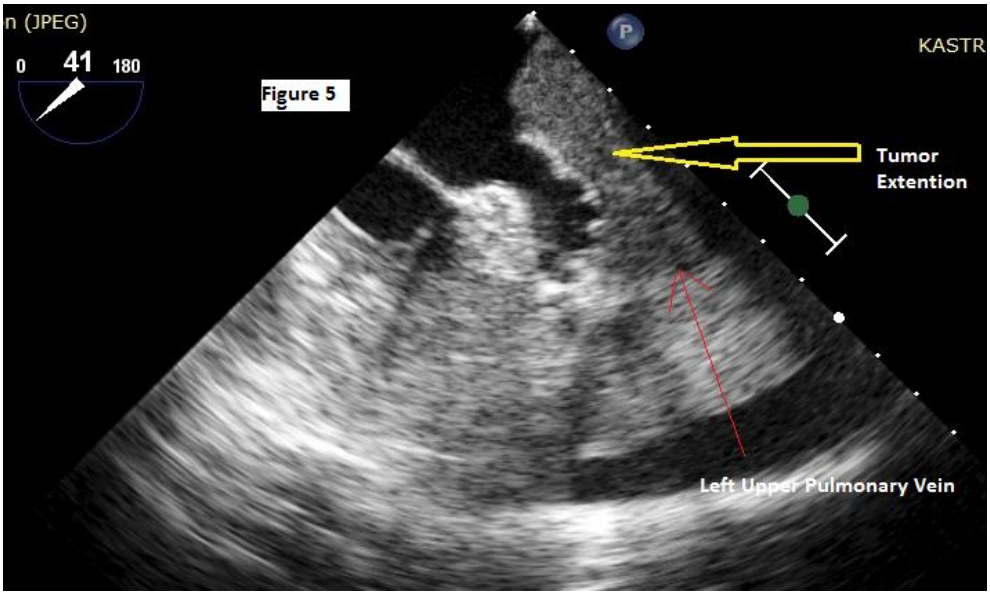
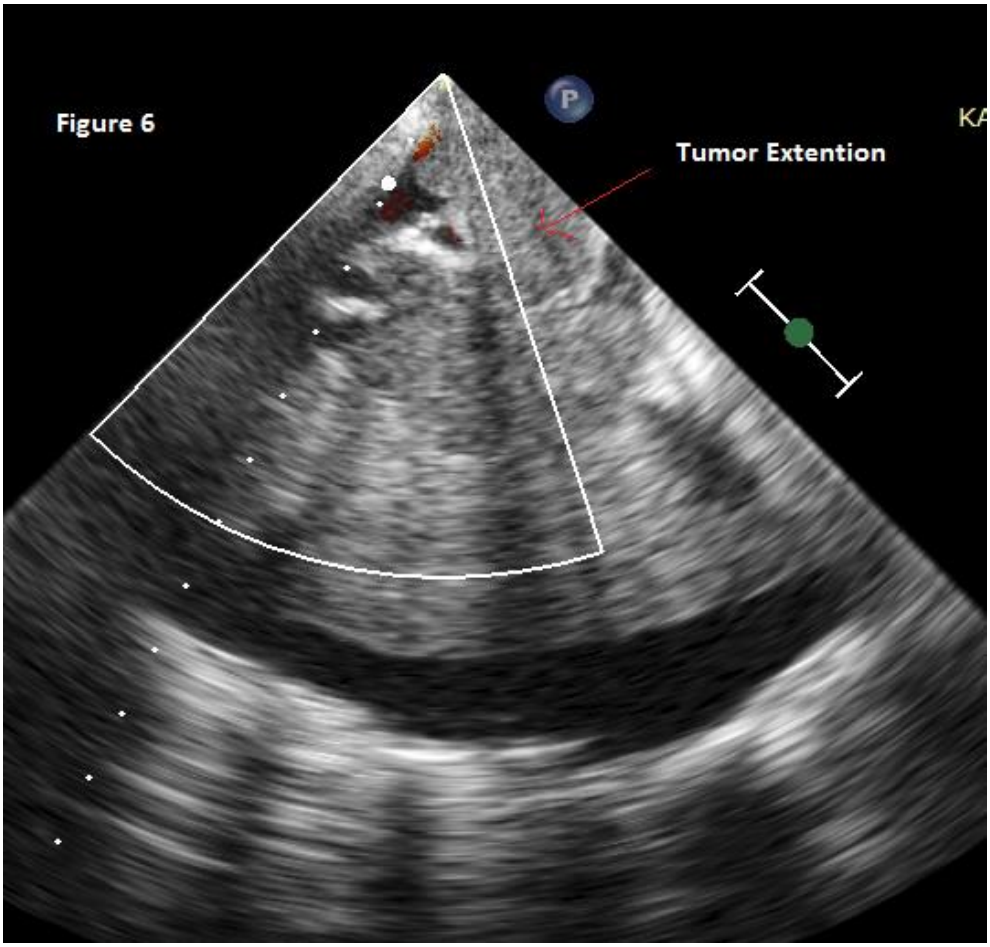


Figure 4. The computed tomography thorax shows infiltration in the left bronchus with severe narrowing in the distal segment.





Figures 5 and 6. The transesophageal echocardiogram shows the left atrium with a spherical echogenic, heterogeneous mass originating from the left upper pulmonary vein obstructing almost 100% of the blood flow.

Video 1. The transthoracic echocardiogram shows the left atrium with a spherical echogenic, heterogeneous mass originating from the left upper pulmonary vein.

Video 2 and 3. The transesophageal echocardiogram shows the left atrium with a spherical echogenic, heterogeneous mass originating from the left upper pulmonary vein obstructing almost 100% of the blood flow.

DISCUSSION

The incidence of primary cardiac malignancies as found in autopsy series is around 0.001% to 0.3%, and that of cardiac metastasis may be about 20 to 30 times higher. [1] Even though cardiac metastasis can be initially asymptomatic, it can cause life-threatening complications like arrhythmias, conduction blocks, myocardial infarction, pericardial tamponade, and pulmonary embolism. In this report, we present a case of lung adenocarcinoma invading the left atrium through the pulmonary vein.

Malignancies with the highest possibility of cardiac metastasis are pleural mesothelioma (48.4%), melanoma (27.8%), lung adenocarcinoma (21%), undifferentiated carcinoma (19.5%), lung squamous cell carcinoma (18.2%), breast carcinoma (15.5%), ovarian carcinoma (10.3%), lympho-myeloproliferative malignancy (9.4%), bronchoalveolar carcinoma (9.8%),

gastric carcinoma (8%), renal carcinoma (7.3%), and pancreatic carcinoma (6.4%). [2] Lung cancer is the most common cancer in the world and also the most common cause of cancer-related deaths. [3] The incidence of cardiac metastasis of lung cancer depends on the histopathological subtype, with adenocarcinoma being the most common. [1]

Tumor extension directly via the pulmonary veins to the left atrium is uncommon. The literature shows that the most common cause is sarcoma rather than the direct extension of bronchogenic carcinoma. [4] Guha et al [5] in 2011 highlighted a worldwide scarcity of reported cases while reporting a left atrial extension of lung carcinoma, which simulated myocardial infarction. Lung carcinoma manifesting as a left atrial mass was reported in Australia [6] and Memphis. [7] Similarly, bronchogenic carcinoma simulating left atrial myxoma was reported from India. [4] Lung carcinoma metastasizing through a pulmonary vein to the left atrium was reported by Lestuzzi et al [8] from Italy, Desai et al [9] from Pittsburgh, and Watanabe and Kubo. [10] Similarly, an atypical hematogenous metastatic invasion of the left atrium from a lung malignancy presenting as a stroke was reported by Cipriano F et al. [11]

The most frequent sites of the metastasis of lung carcinoma include mediastinal lymph nodes, liver, bone, adrenals, and brain. The most common site of cardiac metastasis is the epicardium or the pericardium. [1] Myocardial involvement is less common, while endocardial, intracavitary, or valvular metastasis is the least common. [12] The mechanism of spread is usually through the lymphatic channels. Eighty percent of metastases occur to the right-sided chambers, with the right atrium being the most commonly affected chamber. This is due to the slower flow of the blood in the right chambers, along with the filtering effect of the pulmonary circulation to the left-sided chambers. [13]

Echocardiography is the investigation of choice for the diagnosis of cardiac metastasis. Transesophageal echocardiography confers better visualization of the atria and the great vessels when compared with transthoracic echocardiography, CT, and magnetic resonance imaging (MRI). [14] CT and MRI are helpful as they visualize the location and provide not only detailed morphological features but also information about the extension, local invasion, and mediastinal or pulmonary metastasis. Additionally, they identify fat, calcification, fibrous tissue, melanin, hemorrhage, or cystic changes in the metastatic nodules and offer some degree of histological differentiation. Contrast administration usually helps in differentiating tumors and thrombi. [15]

The management of patients with lung carcinoma with left atrial involvement is primarily nonsurgical and usually palliative with chemotherapy and radiation. [16] Interventions for acute cardiac complications like arrhythmia, pericarditis, tamponade, or infarction may be required. Some lung cancers with left atrial involvement but no systemic metastasis might well respond to surgical resection. With careful selection of patients like excluding those with mediastinal invasion or the involvement of regional lymph nodes, surgical results can be very good as shown in a study involving 15 patients with non–small-cell lung carcinoma (NSCLC) with left atrial involvement who underwent extended pneumonectomy along with left atrial resection without cardiopulmonary bypass where the overall 3-year survival rate was 39%. [17]

CONCLUSIONS

Lung carcinoma has the potential for invading the heart. Cardiac invasion by the tumor can be complicated by the development of multifocal embolic cerebral

infarcts in some cases. Given the aggressive nature of the malignancy, treatment is mainly palliative through chemotherapy with a limited role for surgical intervention.

Decelerations

Funding: This study received no external funding.

Conflict of Interest: The authors report no conflicts of interest.

Ethical Approval: Institutional ethics committee clearance was obtained for the study.

Informed Consent: Written informed consent was taken for the procedures involved and for the publication of anonymized data.

Consent for Publication: Consent for publication was obtained from the patient for the publication of anonymized data.

Data Availability

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available because they contain information that could compromise the privacy of the research participant.

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REFERENCES

1. O'Mahony D, Peikarz RL, Bandettini WP, Arai AE, Wilson WH, Bates SE. Cardiac involvement with lymphoma: a review of the literature. Clin Lymphoma Myeloma. 2008 Aug; 8(4):249-52. doi:10.3816/CLM.2008.n.034. PMID:18765314; PMCID: PMC2998057.

2. Bussani R, De-Giorgio F, Abbate A, Silvestri F. Cardiac metastases. J Clin Pathol. 2007; 60(1):27–34. DOI: 10.1136/jcp.2005.035105.

3. Giuffrida D, Gharib H. Cardiac metastasis from primary anaplastic thyroid carcinoma: Report of three cases and a review of the literature. Endocr Relat Cancer 2001; 8:71-3

4. Mehan VK, Deshpande J, Dalvi BV, et al. Direct extension of bronchogenic carcinoma through pulmonary veins into the left atrium mimicking left atrial myxoma. Chest 1992; 101:1722-3. DOI: 10.1378/chest.101.6.1722

5. Guha P, Sardar P, Mookerjee S, et al. Left atrial extension of lung carcinoma simulating myocardial infarction, unusual presentation: case report and literature review. Tanaffos 2011; 10:69-71.

6. Kadappu KK, Rajaratnam R, Kachwalla H, et al. Lung cancer mimicking left atrial mass. Postgrad Med J 2008; 84:386-7. DOI:10.1136/pgmj.2008.067934

7. Campos P, D'Cruz IA, Dweik HW, et al. Posterior mediastinal spread of bronchogenic carcinoma simulating a mass within the left atrium. Echocardiography 2004; 21:341-3. DOI: 10.1111/j.0742-2822.2004.03115.x

8. Lestuzzi C, Viel E, Mimo R, et al. Left atrial invasion by lung carcinoma through a pulmonary vein. Int J Cardiovasc Imaging 2001; 17:107-10. DOI:10.1023/A:1010621320976

9. Desai MY, Mankad S. Extension of bronchogenic carcinoma through pulmonary vein into the left atrium detected by echocardiography. Echocardiography 2004; 21:189-91. DOI:10.1111/j.0742-2822.2004.02178.x

10. Watanabe N, Kubo K. Images in cardiology: Intra-left atrial invasive mass extended via the pulmonary vein. Heart. 2001; 85(3):271. DOI:10.1136/heart.85.3.271

11. Cipriano F, Dessoti LU, Rodrigues AJ, Vicente WVA, Chahud F, Evora PRB. A

report of a lung carcinoma extended to the left atrium through the pulmonary vein. J Thorac Dis. 2018; 10(1): E46-E51.

12. Borsaru AD, Lau KK, Solin P. Cardiac metastasis: A cause of recurrent pulmonary emboli. Br J Radiol 2007; 80:e50-3.

13. Hiremath R, KC A, Noronha GP, Naik SB, Tejasvi S. Metastatic cardiac tumor from bronchogenic carcinoma via pulmonary vein: A case report. J Clin Diagn Res 2013;7:2600-1

14. Mihali E, Muresan M, Rusu ML, Fodor D. Cardiac metastasis, and tumor embolism in a patient with adenocarcinoma of the colon presenting with paraneoplastic polymyositis. Rom J Morphol Embryol 2013; 54 3 Suppl: 897-900.

15. Chiles C, Woodard PK, Gutierrez FR, Link KM. Metastatic involvement of the heart and pericardium: CT and MR imaging. Radiographics 2001; 21:439-49.

16. Chandra R, Abugroun A, Goldberg A, Cooney E, Mehrotra S, Volgman A. Small Cell Lung Cancer Invading the Left Atrium With Subsequent Malignant Embolic Stroke: A Case Report and Review of Literature. Cardiol Res. 2019; 10(3):188-192. DOI:10.14740/cr752w

17. Spaggiari L, M DA, Veronesi G, Pelosi G, de Pas T, Catalano G, de Braud F. Extended pneumonectomy with partial resection of the left atrium, without cardiopulmonary bypass, for lung cancer. Ann Thorac Surg. 2005; 79(1):234–240