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Case Report

Pulmonary Metastasis from Renal Cell Carcinoma Noted during Resection under Artificial Cardiopulmonary Support Showing Intra-atrial Extension into Left Atrium

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Summary

A 73-year-old female underwent a left knee arthroplasty procedure. Postoperative fever persisted and a chest computed tomography (CT) and positron emission tomography (PET) examination was performed, which showed a mass shadow in the right lower lobe of lung and a mass in the left atrium. Based on these findings, we suspected intracardiac extension of the lung tumor or another mass in the left atrium, and surgery was planned. Initially, a right lower lobectomy was performed under a video assisted thoracoscopic surgical procedure. The interlobar plane was separated, then the inferior lobe pulmonary artery was dissected, followed by dissection of the lower trunk of bronchus. A tumor was found on the cranial side of the right inferior pulmonary vein. Next, the chest was opened through a median sternotomy and artificial cardiopulmonary support was started. The tumor was found to be extending from the right inferior pulmonary vein toward the mitral valve and extraction was performed from the left atrium. The entire mass was moved to the right thoracic cavity, then the right lower lobe and mass were removed en bloc. Described herein is a rare case of pulmonary metastasis associated with a renal cell carcinoma extending into the left atrium.

Key Words: Metastatic lung tumor, Renal cell carcinoma, cardiac metastases

Introduction

Extension of a renal cell carcinoma from the renal vein into the inferior vena cava and right atrium is not uncommon. However, pulmonary extension of a renal cell carcinoma into the left atrium via the pulmonary vein is extremely rare and, to the best of our knowledge, has not been previously reported. Described herein is a case of pulmonary metastasis associated with a renal cell carcinoma extending into the left atrium that was resected under artificial cardiopulmonary support.

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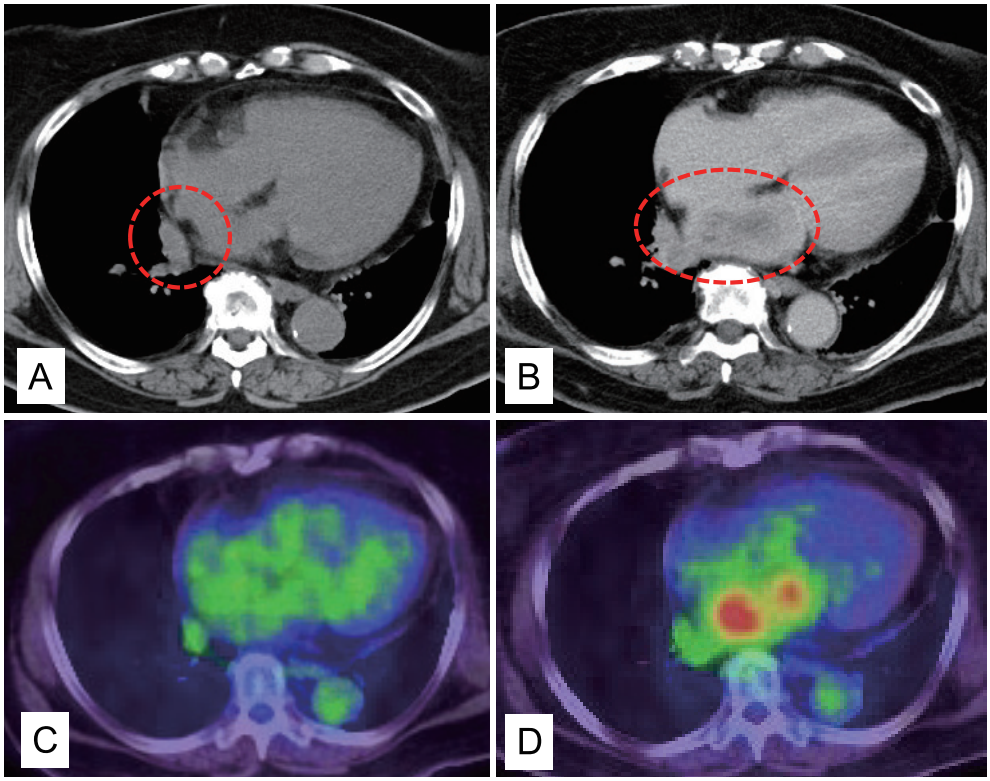

Figure 1 **A;** Chest CT in 2017 showed nodule in right lower lobe, **B;** Chest CT in 2018 showed a mass shadow in the right lower lobe and a mass in the left atrium, **C;** FDG-PET scan in 2017 showed no abnormal uptake value, **D;** FDG-PET scan in 2018 showed a high up take value in the left atrium

Clinical Summary

A 73-year-old female underwent a left knee arthroplasty procedure in May 2018. Postoperative fever persisted and a chest computed tomography (CT) and Fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET) examination was performed, which showed a mass shadow in the right lower lobe and a mass in the left atrium (Fig. 1). She was thus referred to our hospital.

The patient had diabetes mellitus and underwent a right nephrectomy due to renal cell carcinoma in 2010. There was no family history to be noted. Eastern Cooperative Oncology Group Performance status (ECOG-PS) was 2. The patient had a surgical scar from the nephrectomy in the abdomen. Blood biochemistry tests showed a red blood cell count of 3.55 × 109/l, hemoglobin level of 9.5 g/dl, and c-reactive protein level of 4.83 mg/dl, indicating anemia and elevated inflammatory response. Based on these findings, we suspected intracardiac extension of the lung tumor or another mass in the left atrium, and surgery was planned.

Initially, a right lower lobectomy was performed under a complete video assisted thoracoscopic surgical procedure on the right side in a left decubitus position. The interlobar plane was separated, then the inferior lobe pulmonary artery was dissected, followed by dissection of the lower trunk of bronchus. A tumor with a slightly white surface was found on the cranial side of the right inferior pulmonary vein, while the inferior pulmonary vein was left untouched. Next, the patient was placed in a supine position. The chest was opened through a median sternotomy and artificial cardiopulmonary support was started using the ascending aorta, superior vena cava, and inferior vena cava tube cannulation.

When the left atrium was incised and expanded in the direction of the right inferior pulmonary vein, a yellowish-white smooth-surfaced mass occupying the left atrium was identified (Fig. 2). The tumor was found to be extending from the right inferior pulmonary vein toward the mitral valve and extraction was performed from the left atrium, with the right inferior pulmonary vein incised circumferentially. After con-

firming that the tumor originated from the right thoracic cavity, the pleura and pericardium were incised, and the entire mass was moved to the right thoracic cavity, then the right lower lobe and mass were removed en bloc.

The tumor was located in the parenchyma and hilar lymph node, with extension into the inferior pulmonary vein, and measured 7.5 × 2.5 × 2 cm (Fig. 3A). Histopathology findings showed tumor cells with small round nuclei and pale cytoplasm, with hemorrhage and necrosis in the stroma, which led to a diagnosis of pulmonary metastasis of clear cell renal cell carcinoma (Fig. 3B). The patient had a good postoperative course and was discharged on day 18.

Discussion

Approximately 30% of renal cell carcinoma cases develop systemic metastasis, most commonly in the lungs, bones, soft tissues, liver, and central nervous system[1]. While metastasis to the lungs is generally via a hematogenous route from the renal vein to inferior vena cava[2], in the present patient metastasis to the lungs extended and invasion of the left atrium via the inferior pulmonary vein was noted, an extremely rare form. A previous report noted that in 4-10% of renal cell carcinoma cases, tumor embolization is formed by direct extension from the renal vein to the inferior vena cava[3], with the biological predisposition leading to direct intravascular invasion also known[4]. In the present case, the pulmonary metastasis may have extended into the left atrium by the same mechanism.

Renal cell carcinoma metastasis to a ventricle is a rare finding and two mechanisms have been postulated. One is caused by backflow of lymphatic channels in the posterior wall of the heart caused by lymph node metastasis in the chest, while the other is by a venous pathway from the renal vein to right ventricle[5]. The present case of left atrial invasion from pulmonary metastasis demonstrated a completely different mechanism. Preoperative CT findings indicated that the left atrial tumor was larger than the intrapulmonary lesion. FDG-PET showed abnormally high results, with the left intra-atrial tumor having a greater concentration with a maximum standardized uptake value (SUV) of 8.3. On the other hand, FDG-PET findings showed a maximum SUV for the lung tumor of 2.5, suggesting that the left intra-atrial metastasis might have initially extended to the lung. However, since the pulmonary lesion was originally noted in the

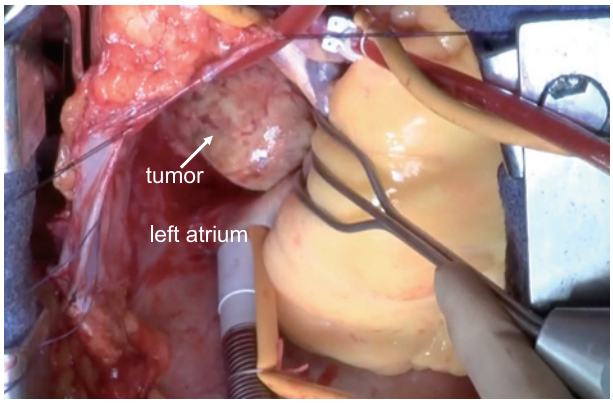

Figure 2 A yellowish-white smooth-surfaced mass occupying the left atrium was identified (white arrow)

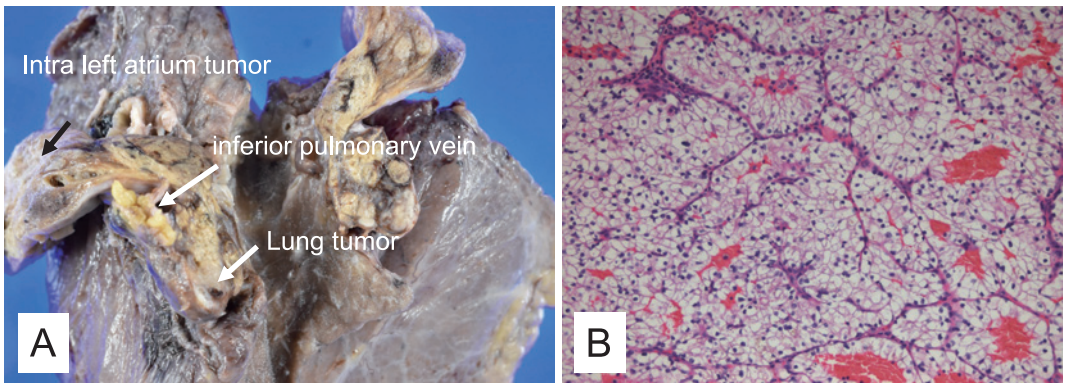

Figure 3 **A;** Macroscopic findings showed the tumor was located in the parenchyma and hilar lymph node, with extension into the inferior pulmonary vein and left atrium, **B;** Histopathology findings of hematoxylin and eosin stain showed tumor cells with small round nuclei and pale cytoplasm, with hemorrhage and necrosis in the stroma.

first CT examination, it was determined to be intra-atrial extension from pulmonary metastasis.

Initially, surgery was performed in a left decubitus position under a complete video assisted thoracoscopic dissection of the interlobar plane, pulmonary artery, and bronchus. That was followed by en bloc removal of the right lower lobe and intracardiac tumor under artificial cardiopulmonary support with a sternotomy approach in a supine position, as it was considered difficult to secure adequate fields of view of the right lower lobe and left atrium at the deepest part of the dorsal side, and turn over the lung with a complete video assisted thoracoscopic surgical procedure. In addition, the initial resection was not performed under artificial cardiopulmonary support, because the tumor could possibly become disseminated during surgery. If the operation had been performed with only a median sternotomy, a large right thoracotomy might have become necessary, resulting in an invasive major surgical procedure. Also, minimally invasive cardiac surgery (MICS) instead of a median sternotomy might have been a useful option. However, we opted for a median sternotomy for two reasons. First, the location and size of the tumor in the left atrium was unclear, and we wanted a wide field of view to ensure resection. Second, we wanted to avoid the risk of intraoperative tube trouble as much as possible. For these reasons, a median sternal incision was selected. There were no major postoperative complications, thus the methods used were considered to be the best choice for this case.

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References

1) Motzer RJ, Mazum DM, Bacik J, et al.: Survival and prognostic stratification of 670 patients with advanced renal cell carcinoma. J Clin Oncol **17**: 2530-2540, 1999.
2) Pagano F, Dal Bianco M, Artibani W, et al.: Renal cell carcinoma with extension into the inferior vena cava: problems in diagnosis, staging and treatment. Eur Urol **22**: 200-203, 1992.
3) Li Q, Wang Z, Ma X, Tang J, et al.: Diagnostic accuracy of contrast-enhanced ultrasound for detecting bland thrombus from inferior vena cava tumor thrombus in patients with renal cell carcinoma. Int Braz J Urol **46**: 92-100, 2020.
4) Rehman ZU, Ather MH, Aziz W: Surgical Interventions for Renal Cell Carcinoma with Thrombus Extending into the Inferior Vena Cava: A Multidisciplinary Approach. Ann Vasc Dis **12**: 55-59, 2019.
5) Miura S, Yamada A, Iba Y, et al.: Surgical treatment of isolated right ventricular metastasis from renal cell carcinoma. Surg case Rep **5**: 162, 2019.