



Case Report

Organizing Pneumonia Induced by Ablative Radioembolization for the Treatment of Hepatic Metastatic Renal Cell Carcinoma

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ABSTRACT

Organizing pneumonia is a recognized complication after external beam radiotherapy of breast and lung cancer but has not been described after radioembolization. A 67-year-old female who underwent ablative trans-arterial radioembolization for the treatment of hepatic metastatic renal cell carcinoma adjacent to the diaphragm presented with computed tomography findings of asymptomatic organizing pneumonia in the lower lobes. A follow-up computed tomography 8 months after conservative management demonstrated near-total resolution of the previous pulmonary parenchymal disease. The patient continues to remain asymptomatic and shows no evidence of residual tumor 10 months after radioembolization.

Key words: Radioembolization, Radiation pneumonitis, Organizing pneumonia

INTRODUCTION

Organizing pneumonia (OP) is a recognized complication after external beam radiotherapy (EBRT) of breast and lung cancer but has not been described after trans-arterial radioembolization. OP can be distinguished from radiation pneumonitis (RP) by its distinct clinical and radiologic manifestations. To our knowledge, this is the first case report documenting the diagnosis and management of OP induced by radioembolization.

CASE REPORT

A 67-year-old female with a history of metastatic renal cell carcinoma (mRCC) to the liver refractory to Nivolumab and Avastin presented for locoregional therapy. There were two conglomerate tumors in hepatic segments 7 and 8 measuring 7.2 cm in maximal diameter [Figure 1a]. The patient had an eastern cooperative oncology group score of 0, albumin-bilirubin grade of A1, and was deemed to be a candidate for segmental ablative radioembolization. Mapping angiography demonstrated hypervascular tumors supplied by the segment 7 and 8 angiosomes without parasitization of the phrenic artery [Figure 1b]. 2 mCi of TcMAA was administered via the planned treatment vessels with subsequent SPECT/CT scintigraphy demonstrating a lung shunt of 1%. Ablative radioembolization was performed 2 weeks later using Yttrium 90 containing glass microspheres (TheraSphere, BTG International Group; London, United Kingdom) with a Medical Internal Radiation Dose of 377 gray (Gy), 388 Gy, and 311 Gy delivered to the

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segment 7, dorsal segment 8, and ventral segment 8 arteries, respectively [Figure 1c]. The total estimated lung dose was 0.5 Gy which was verified with post-procedural voxel dosimetry analysis (MIM Sureplan, Cleveland, OH) (Liver lesions: 2707 max counts; right lung 154 max counts (5.7%); left lung 45 max counts (1.7%)). The tumor demonstrated an mRECIST complete response per MRI three months after treatment [Figure 2a-c]. Pulmonary parenchymal changes were noted 11 mm beyond the ablation zone suggesting ablative radioembolization had generated a radiation margin within the adjacent lung. Computed tomography (CT) of the chest was subsequently obtained 3 months after treatment demonstrating new geographic mixed ground glass and consolidation in the right lower lobe abutting the diaphragm in close proximity to the treated liver lesions [Figure 3a]. The patient was asymptomatic and denied shortness of breath, dyspnea on exertion, fever, or aspiration. Approximately 6 months after radioembolization, surveillance positron

emission tomography-computed tomography (PET-CT) demonstrated new bibasilar mixed peripheral airspace consolidation with central ground-glass opacities compatible with a reversed halo sign (atoll sign) highly suggestive of organizing pneumonia [Figure 3b]. The findings were reviewed by the interventional radiology, chest imaging, and nuclear medicine teams, as well as her local pulmonologist, and a working diagnosis of OP was established given the patient's lack of symptoms. Similar to the pathophysiology of EBRT derived OP, it was suspected that the margin generated by higher energy Yttrium 90 beta particles emitted from the hepatic dome irradiated the adjacent lung and stimulated the development of OP in the lower lobes. The patient chose to pursue conservative management without steroids. A chest CT 8 months after radioembolization demonstrated near-complete resolution of OP [Figure 3c]. The patient continues to remain asymptomatic and has shown no signs of tumor recurrence 10 months after radioembolization.



Figure 1: 67-year-old asymptomatic woman with hepatic metastatic renal cell carcinoma who presented with organizing pneumonia after radioembolization treatment. (a) Pre-procedure contrast-enhanced MRI demonstrated conglomerate renal metastases in segments 7 and 8 adjacent to the diaphragm. (b) Catheter angiography demonstrates hypervascular metastases supplied by three arterial conduits. (c) Postradioembolization bremsstrahlung SPECT/CT demonstrates activity within the targeted angiosomes covering both tumors and a margin.

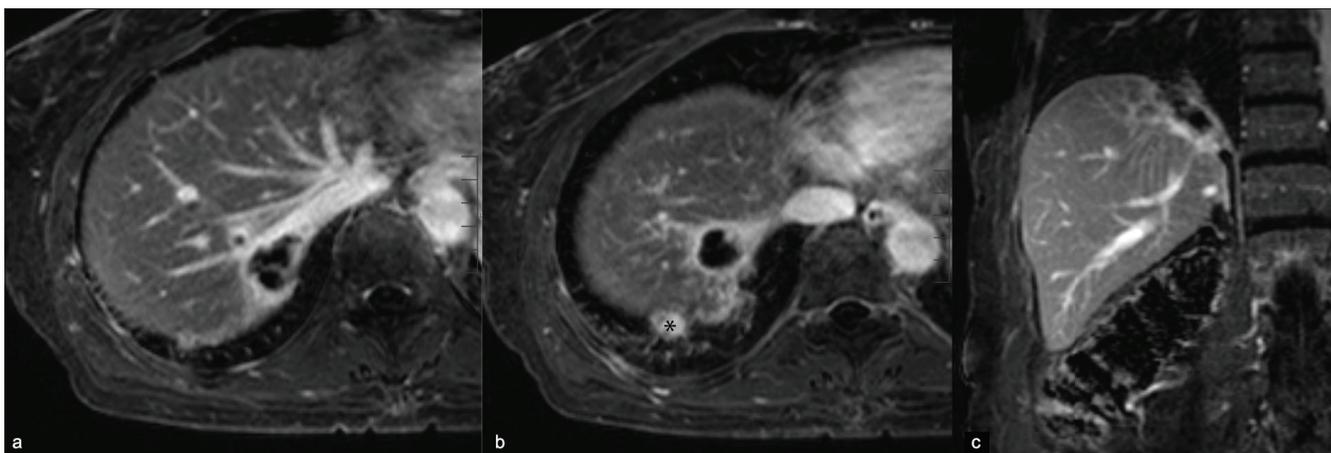


Figure 2: 67-year-old asymptomatic woman with hepatic metastatic renal cell carcinoma who presented with organizing pneumonia after radioembolization treatment. (a-c) Contrast-enhanced MRI performed three months after TARE demonstrates tumor necrosis without evidence of residual disease. There is also an enhancement of pulmonary parenchyma abutting tumor margin*.

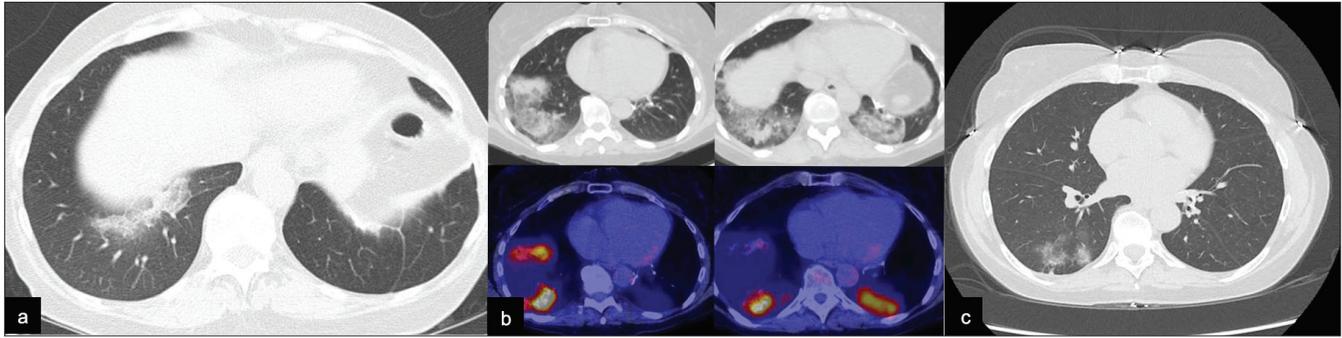


Figure 3: 67-year-old asymptomatic woman with hepatic metastatic renal cell carcinoma who presented with organizing pneumonia after radioembolization treatment. (a) Non-contrast CT with lung windows 3 months after TARE demonstrates geographic mixed ground glass and consolidation in the right lower lobe. (b) Noncontrast CT with lung windows 6 months after TARE demonstrates bibasilar reversed halo (atoll) signs most consistent with OP. Concurrent PET/CT image at the same level demonstrates increased metabolic activity predominantly in the peripheral areas of consolidation. (c) Non-contrast CT with lung windows 8 months after TARE demonstrates near resolution of mixed consolidation and ground glass opacities in the lung bases.

DISCUSSION

EBRT induced OP is a well-recognized entity, commonly described in the setting of breast cancer treatment.^[1] A systematic review found that OP occurs in 0.8–2.9% of patients receiving EBRT for breast cancer.^[1] Case reports have also demonstrated OP after EBRT of mediastinal lymph nodes and lung cancer.^[2,3] This entity is important to differentiate from RP because it can be definitively cured with steroids and has a more favorable prognosis with no reported deaths.^[1] RP secondary to radioembolization can have a high mortality rate and while treatment with steroids and pentoxifylline is reported, there is little evidence to support efficacy.^[4,5] RP is rare with an incidence of less than 1% and is usually seen when the lung shunt fraction is > 20% or absorbed lung dose is > 30 Gy, but it has also been reported with lung doses as low as 10.4 Gy.^[4,5] This patient's lung shunt was 0.5 Gy and both the radiologic and clinical manifestations were characteristic of OP. The patient was asymptomatic and given these characteristics findings, a biopsy was not performed, consistent with the guidelines of the largest systemic review.^[1] OP can be seen within a week to over 1 year after EBRT and the diagnosis can be differentiated from radiation pneumonitis based on imaging and clinical assessment.^[1] OP can present both in and out of the radiation field and is characterized by migratory airspace consolidation surrounded by ground-glass opacification with or without airway dilatation. RP is confined to the radiation field and presents as central perihilar ground-glass opacities, pleural retraction, and chronic findings such as lung fibrosis.^[6] The pathophysiology of EBRT induced OP is not fully understood but may be related to the activation of pulmonary lymphocytes and immune-mediated consolidation.^[3,7,8] Symptomatic OP is successfully managed with steroids while asymptomatic cases may be observed.^[1] Patients should be monitored to ensure resolution of

symptoms and radiographic findings which usually occurs within weeks to months after treatment but can take up to a year.^[1]

CONCLUSION

TARE induced OP is important to diagnose and differentiate from RP due to its distinct clinical management and favorable prognosis.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest. Beau Toskich is an advisor for BTG, Johnson and Johnson, Boston Scientific, and AstraZeneca.

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