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Authors
Guemidjian, Adam
Wright, Cari
Daly, Megan

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Radiation Induced Unilateral Vocal Fold Paralysis Following Lung Stereotactic Ablative Radiation Therapy: A Case Report and Review of the Literature

Adam Raffi Guemidjian BS, Cari L. Wright CMD, Megan E. Daly MD

Introduction

Stereotactic ablative radiotherapy (SABR) is a standard-of-care treatment for medically inoperable, early-stage lung cancer, with local control exceeding 90% in many studies [1]. Prospective trials report low rates of toxicity following SABR to peripherally locally tumors, with increased risks for “central” tumors [2, 3]. Peripheral neuropathy following high biologic effective dose (BED) to a peripheral nerve is an uncommonly reported risk. In this case report, we present a case of suspected radiation-induced unilateral vocal cord paralysis (VCP) secondary to peripheral nerve injury in a patient treated with two courses of SABR to the left upper lobe for metachronous primary early-stage non-small cell lung cancer (NSCLC) in proximity to the recurrent laryngeal nerve (RLN) and vagal nerve (VN).

Case Presentation/Results

An 81-year-old male was diagnosed with Stage 1A NSCLC measuring 1.8cm. He was determined to be medically inoperable. He underwent SABR to 60 Gy in 5 fractions of 12 Gy each (Figure 1a). Three years later, a new lung nodule was noted on surveillance imaging in the left hilum adjacent to a branch of the left pulmonary artery. Biopsy confirmed adenocarcinoma, consistent with a new primary early-stage NSCLC. He was treated with SABR to 50 Gy in 5 fractions to the centrally located left hilar tumor (Figure 1b).

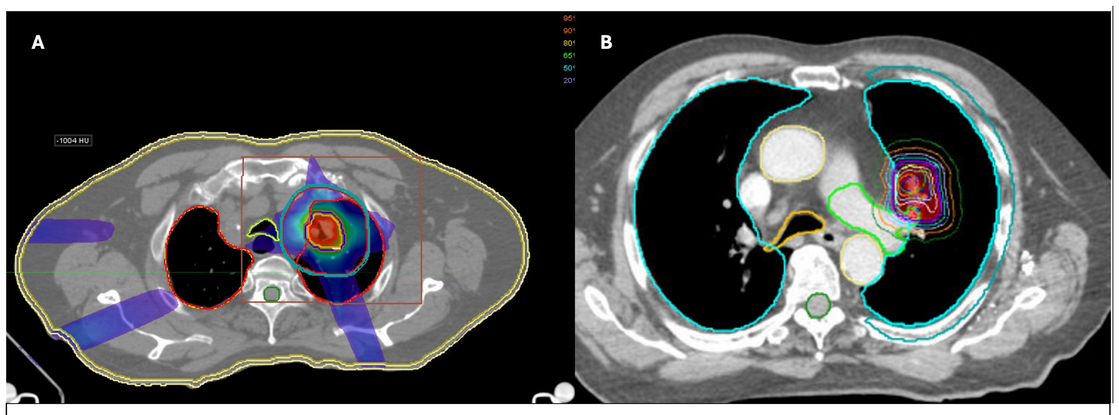

Figure 1A and 1B

Ten months later, the patient reported recent onset of voice hoarseness at a follow up visit. Positron emission tomography (PET)/computed tomography (CT) obtained at that time noted hypometabolism of the left true vocal fold suggestive of left VCP, with no evidence of recurrent lung cancer (Figure 2a). Left VCP was confirmed by nasopharyngolaryngoscopy (Figure 2b). The patient’s voice did not correct, and the VCP remained permanent. Retrospective dosimetric review was performed of both treatment plans to estimate point maximum dose to the RLN and VN (Figure 3 a and b). A composite plan was generated and identified a cumulative estimated maximum dose to the RLN of 39.62 Gy and 76.28 Gy to the VN (Figure 3b).

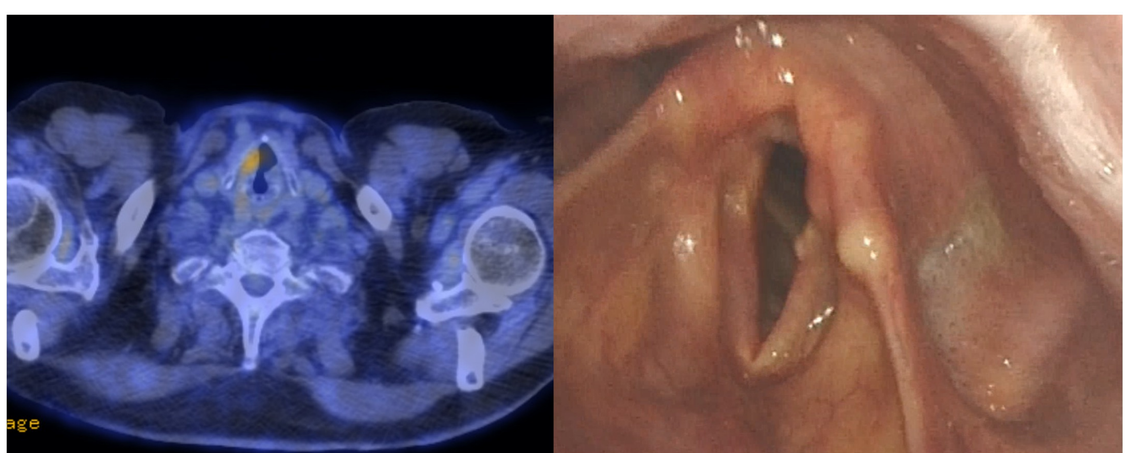

Figure 2A and 2B

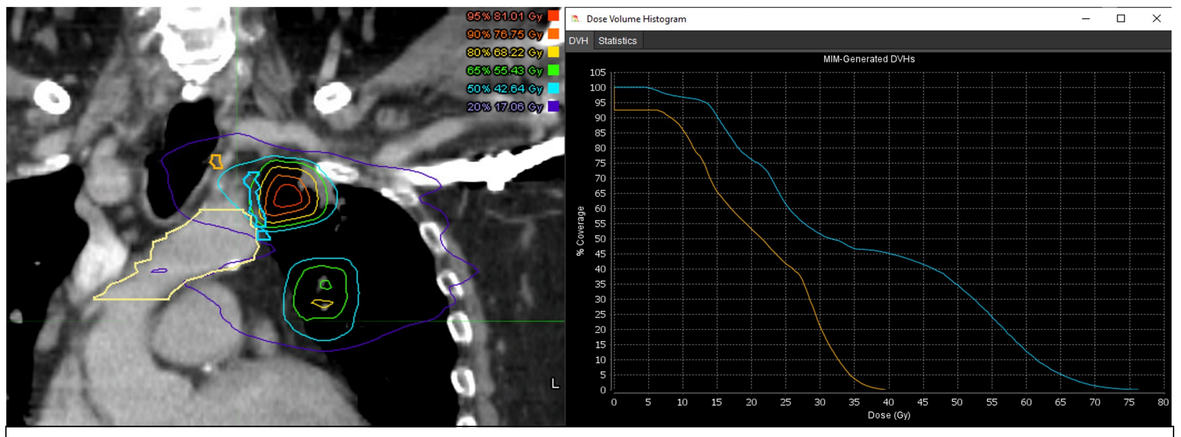

Figure 3A and 3B

Discussion

Injury to peripheral nerves is a potential and underappreciated risk of radiation. Several case reports and small case series describe unilateral VCP believed to be secondary to RLN or VN neuropathy following SABR for tumors of the left upper lobe. The left RLN wraps around the aortic arch before ascending to the larynx, potentially exposing the RLN to high doses when treating centrally located lung tumors with SABR. The left VN descends in the chest to the left of the aorta, potentially adjacent to centrally located left upper lobe lung tumors. Injury to the RLN or the vagal nerve above the branch point of the RLN may result in unilateral VCP and is typically permanent [4].

Our patient’s VN received a high BED during the first course of SABR due to lack of prospective contouring and constraining of the VN, and doses to the RLN also exceeded typical constraints for other peripheral nerves. The injury appears more likely attributable to the first course of SABR despite the long latency after the first SABR course.

Conclusions/Further Study

Radiation induced injury to the VN or RLN is a rare but potentially underreported complication following SABR for tumors of the lung, particularly the left upper lobe. As unilateral VCP can have significant impact on patient quality of life, radiation oncologists should be aware of this potential complication and consider prospective contouring of the VN and RLN for tumors adjacent to the expected anatomic course. Patient should also be counseled about the potential risk of this complication when treating anatomically at-risk tumors.

Because of the limited cases of vagal or RLN injury resulting in VCP following thoracic SABR reported, safe radiation dose limits are unknown but are typically extrapolated from other peripheral nerves including the brachial and lumbosacral plexi. The capacity of peripheral nerves for repair from radiation damage over time is poorly studied, but both animal and human data also suggest nerve tissue has considerable repair capacity over time. Collection of larger case series may allow for better estimation of the dose tolerance of peripheral nerves to hypofractionated radiation and allow more precise risk estimates for future patients.

Acknowledgements/References

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