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Successful Use of Photodynamic Therapy in a Patient with Squamous Cell Carcinoma of the Lung and Diffuse Endobronchial Lesions

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Abstract

Field cancerization, a phenomenon in which multiple tumors arise in a carcinogen-damaged field could potentially explain the synchronous and metachronous premalignant or malignant lesions surrounding the primary tumor in smokers with aerodigestive malignancies. We report the case of a patient with invasive squamous cell carcinoma (SqCC) of the lung, complicated by multiple synchronous, radiologically silent endobronchial lesions. He underwent successful treatment with stereotactic body radiation therapy (SBRT) followed by adjuvant photodynamic therapy (PDT). We wish to highlight the need for more prospective clinical studies to determine which patient population would be appropriate for early bronchoscopic evaluation and the efficacy of using multimodal therapies like PDT for field cancerization. Further studies could not only give clinicians the opportunity to diagnose radiologically silent endobronchial lesions, but could also lead to using multimodal therapies against field cancerization.

Keywords: Field cancerization, Photodynamic therapy, Squamous cell carcinoma, Endobronchial lesions

Lung cancer is the second most commonly diagnosed cancer and the leading cause of cancer-related death in the United States, with a mortality rate of 51.6 and 34.4 per 100,000 among men and women respectively.¹ Non-small cell lung cancers constitute the majority of disease burden associated with lung cancer (85%), out of which about 35% of the cases are accounted for by squamous cell carcinoma (SqCC) of the lung.² There have been numerous recent therapeutic advancements with immune checkpoint inhibitors, stereotactic body radiation therapy (SBRT), and sublobar surgical resections. Other therapies such as photodynamic therapy (PDT) remain underutilized in the treatment of lung cancer.³

PDT is a type of non-ionizing radiation therapy that uses a photosensitizer and light to exert anti-cancer activity through apoptotic or necrotic tumor

cell death. The mechanism of action of PDT is highlighted in Fig. 1.⁴

Field cancerization, a phenomenon in which multiple tumors arise in a carcinogen-damaged field, could potentially explain the synchronous and metachronous premalignant or malignant lesions surrounding the primary tumor in smokers with aero-digestive malignancies.⁵ However, there is a lack of evidence related to the appropriate management of these lesions using newer modalities such as PDT.

We report the case of a patient with invasive squamous cell carcinoma (SqCC) of the lung, complicated by multiple synchronous endobronchial lesions who underwent successful treatment with SBRT followed by adjuvant PDT.

A 51-year-old African American man with a 30 pack-year smoking history presented to his primary

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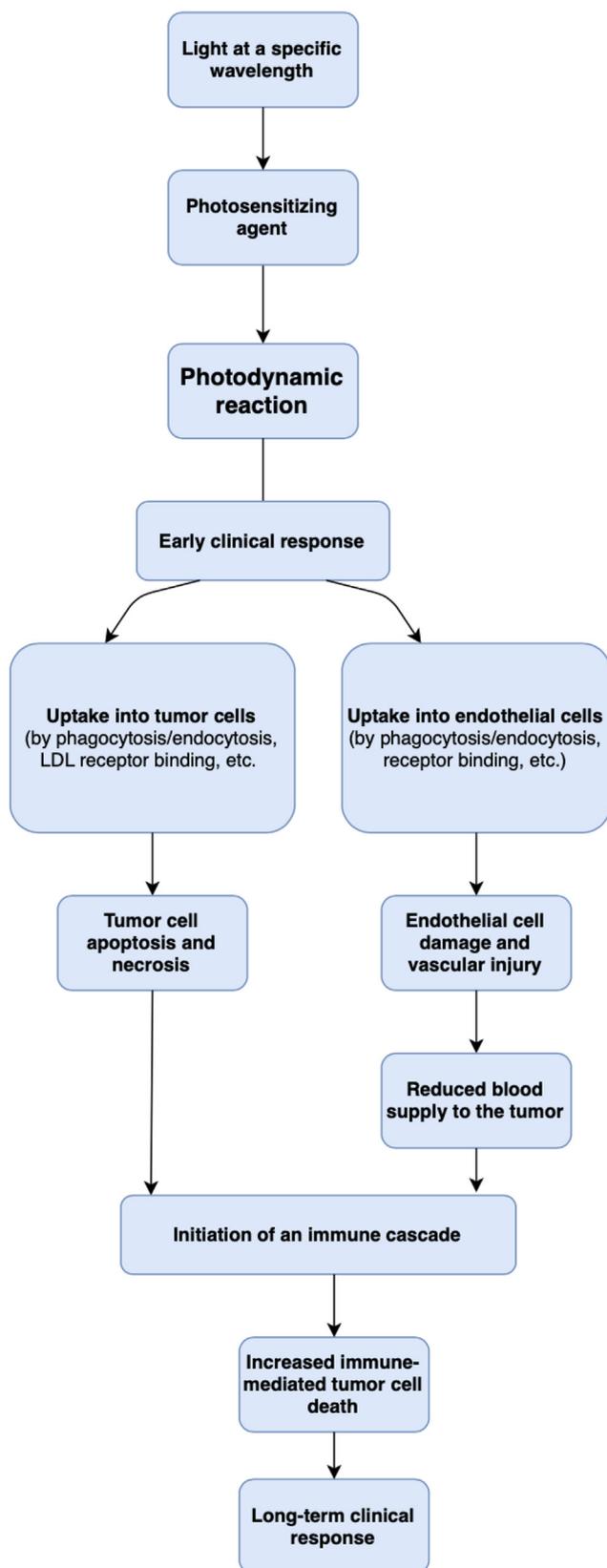


Fig. 1. Illustration depicting the mechanism of action of photodynamic therapy as an anti-cancer therapy, resulting in an early and long-term clinical response.

care physician for a 6-month history of weight loss and shortness of breath. He was not currently smoking. Chest x-ray and a subsequent computed tomography (CT) scan of the chest revealed a 1.7×1.3 cm spiculated left lower lobe nodule. The patient underwent navigation bronchoscopy and staging linear endobronchial ultrasound, which revealed invasive squamous cell carcinoma with no lymph node metastases. Endobronchial lesions were found in the right upper lobe anterior segment, proximal left upper lobe bronchus, and left main carina; biopsy of all three lesions revealed invasive SqCC. Positron emission tomography scan revealed no evidence of metastatic disease. The patient was determined to have T2b N0 M0 (stage IA2) squamous cell carcinoma along with three synchronous endobronchial T1a lesions.

The patient received definitive SBRT targeted at the left lower lobe lesion. After 6 weeks of recovery time, he underwent porfimer PDT targeted at the three endobronchial lesions. CT chest and repeat bronchoscopy 3 months after completion of SBRT and PDT revealed decrease in the size of the LLL nodule and resolution of the endobronchial lesions (Fig. 2). The patient was initiated on radiographic (every 3 months) and bronchoscopic (every 6 months) surveillance. The patient continues to stay in remission after 2 years.

Our case demonstrates excellent response to multimodal therapy for bronchogenic SqCC. Our approach treats these lesions as a product of field cancerization rather than hematogenous metastasis. Adequate treatment of these lesions is vital to prevent recurrence of lung cancer.⁶ Our strategy was driven by the presence of both a peripheral nodule and multiple radiographically occult lesions, which could not have been discovered and treated without bronchoscopic evaluation at the time of our patient's cancer diagnosis and without the use multimodal therapies. PDT, which uses photosensitizing agents to cause cell death, is more commonly used for symptomatic airway obstruction from bronchogenic carcinoma.^{7,8} In our case, PDT was used with curative intent against non-obstructive lesions.

We wish to highlight the need for more prospective clinical studies to determine which patient population would be appropriate for early bronchoscopic evaluation and the efficacy of using multimodal therapies like PDT for field cancerization. The use of PDT in radiologically occult lung cancers has been shown to be effective, however more studies are needed to determine its efficacy against multiple primary lesions from field cancerization.⁹ Further studies could not only give clinicians the opportunity to diagnose

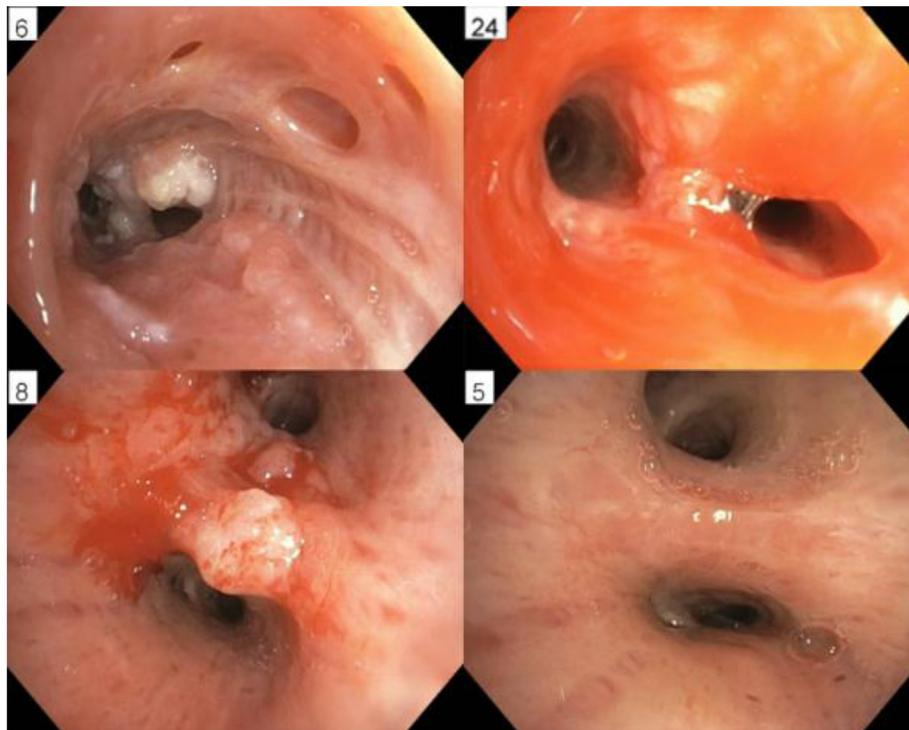


Fig. 2. Top row: before and after PDT therapy of the right upper lobe lesions. Bottom row: before and after PDT therapy of the left main carina lesions. PDT= Photodynamic therapy.

radiologically silent endobronchial lesions, but could also lead to using multimodal therapies against field cancerization.

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None to declare.

Conflicts of interest

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All authors had access the data and a role in writing the manuscript.

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