Proton Therapy for Lung Cancer: New Data to Consider

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By Jeffrey C. Buchsbaum, MD, PhD [1] and Peter A. S. Johnstone, MD [2]

The role of radiation therapy (RT) in lung cancer is long established; some of the earliest Radiation Therapy Oncology Group reports dealt with non-small cell lung cancer (NSCLC).[1,2] More recently, the advent of stereotactic body RT (SBRT) techniques has provided significant local control rates after focused treatment of selected small metastases and inoperable early stage lesions.[3,4] Our center has been in the forefront of examining SBRT and its role in central [5] or bilateral [6] lesions, its effect on PET imaging [7] and pulmonary function testing,[8] and subsequent frequency of brachial plexopathy,[9] chest wall toxicity,[10] or pneumonitis.[11] Still, even this highly conformal technique comes with potentially significant dose to adjacent normal tissue. This is in the context of an emerging appreciation for the pulmonary consequences of elevated mean lung dose,[12] or V5 after pneumonectomy.[13] For each lung cancer patient requiring RT, an effective mechanism to deliver dose to the tumor while minimizing dose to uninvolved lung is called for. Enter protons.

Our department provides care at the Midwest Proton Radiotherapy Institute (MPRI). There, we have preferentially treated pediatric patients and adults with complex head and neck or CNS lesions. However, in some cases we have treated lung cancer patients, often with recurrent lesions after conventional RT where the disease threatens normal structures such as the spinal cord. The finite depth of proton penetration is especially appropriate for patients with good performance status, and integral lung dose using protons is usually far less than using conventional RT. The MPRI approach is similar to the Loma Linda approach described in the article by Bush, except that MPRI nozzles provide a form of active scanning that is similar to the passive beam shaping which he and others [14] describe as optimal for a proton beam treating lung tissue. However, while the scanning beam available at MPRI is indeed less sensitive to tumor motion than spot beam scanning, the possibility of delivering non-uniform dose to the target must be mitigated for each patient. Otherwise, even if a large margin is used in the treatment plan, dose inhomogeneity will occur, since the treatment volume in most cases includes motion of the lesion.

This review of proton therapy for lung tumors demonstrates, in logical progression, the reasons why protons may be a reasonable treatment option. Bush demonstrates the critical nature of volume integral dose. In lung, the data for proton therapy are encouraging and others have confirmed that plans that are achievable demonstrate superior avoidance of normal tissue.[14] We believe that proton RT provides an exciting mechanism to provide ionizing radiation to tumor tissue in general, and lung in particular.

In the meantime, we have a responsibility to analyze the technology since it may offer superior outcomes to our patients. With more data, we will progress past articles justifying proton use in general to articles analyzing which patients are best suited to receive proton therapy over other modalities; comparison of the promising areas of stereotactic proton therapy and SBRT; and ways to make the technology more affordable to both buy and use. Bush’s article is well-written, covers the topic well, and presents the data in an accessible fashion. We look forward to seeing other proton data for lung cancer, and to presenting our data from MPRI when available.

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**References:**


