



CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:
RP160661

Project Title:
Towards Carbon Beam Stereotactic Body Radiation Therapy (C-SBRT) for
Higher Risk Early Stage Lung Cancer

Award Mechanism:
Multi-Investigator Research Awards (Version 2)

Principal Investigator:
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Entity:
The University of Texas Southwestern Medical Center

Lay Summary:

Lung cancer is the second most common type of cancer and the number one cause of cancer death in the United States. About 90% of lung cancers are non-small cell lung cancer (NSCLC). Patients with NSCLC may be treated with surgery, radiation therapy, chemotherapy, or a combination of these therapies. Radiation therapy continues to be the primary treatment for 60% of patients. Stereotactic body radiotherapy (SBRT) is a radiotherapy method that delivers a high dose of radiation to the cancer target with a high degree of precision through a small number of fractions. Over the years, SBRT has been successfully employed to early stage NSCLC using megavoltage X-ray beams. Clinical trials have clearly demonstrated high local control and improved survival benefits over conventional therapy. However, current SBRT under X-ray beam therapy has limitations for higher risk lesions, e.g. those with larger and/or centrally located tumors, due to unacceptable toxicity to normal tissues.

Advanced heavy ion radiation therapy, e.g. carbon therapy, offers a new solution to this problem. Because of the unique physics and radiobiology of a carbon beam, much reduced dose to normal tissues can be achieved without compromising dose to the tumor, holding a great potential for treating those higher risk early stage NSCLCs with SBRT. UT Southwestern Medical Center (UTSW) is currently in the process of constructing a carbon ion therapy facility, likely the first one in the United States. This effort has received supports from National Institute of Health (NIH) under a P20 grant, as well as from the state of Texas with annual funds. One of the clinical focuses of our carbon ion therapy center is to transform the lung cancer treatment by delivering carbon beam SBRT (C-SBRT) for higher risk early stage NSCLCs. However, prior to conducting clinical trials, novel technologies need to be developed to ensure an accurate, robust, and safe dose delivery required by lung cancer C-SBRT, posing substantially technical challenges. These technologies are critical to the entire treatment process including treatment planning, beam range verification, treatment adaptation, and delivery monitoring. The current research program will perform a large-scale, coordinated, and interdisciplinary investigation to develop novel and carbon therapy-specific technologies to realize lung cancer C-SBRT. The rationale is that conducting the proposed research and development will lay a solid technical foundation to permit immediate clinical trials of using C-SBRT treatment for higher risk early stage NSCLCs as soon as our carbon therapy facility becomes clinically ready around 2021 as planned. The program integrates five projects:

1) spectral CT for accurate patient modeling needed in carbon therapy planning; 2) Monte Carlo-based treatment planning; 3) positron-emission-tomography based online beam range verification; 4) treatment adaptation strategies to compensate for anatomic and dosimetric variations; and 5) real-time volumetric imaging and dose reconstruction for treatment safety and adaptation. In addition, we also propose to build a core resource of high-performance computing and data management facility to support the large-scale computation and data management needed in all the five projects. An administrative core will be implemented to oversee the entire project and coordinate the investigations.

Upon completion, it is expected that key technologies will have been developed and we will be ready for clinical trials of C-SBRT treatment for higher risk early stage NSCLCs, directly benefiting cancer patients in Texas and beyond. It is also expected that the proposed research and development will be published and shared with other carbon therapy centers around the world, and will be applicable to other tumor sites and other treatment methods, generating broader impact. We also expect this research may lead to the development of several commercial products, potentially contributing to the economy of the State of Texas.