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Abstract
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Impact of Respiratory Motion Management Selection on Success Rate of Non-Small-Cell Lung Cancer (NSCLC) Stereotactic Body Radiation Therapy (SBRT) Protocol at Roswell Park Comprehensive Cancer Center

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Abstract

Objectives:

The use of SBRT for NSCLC is being examined on protocol I1307721. This is a single site study out of RPCCC and is an adaptation of RTOG protocol 0816. Over 700 patients have been treated on this study resulting in approximately 50 failure cases. It was hypothesized that due to the nature of SBRT, motion management related concerns may be impacting the success rate of the protocol. The current study aims to examine a variety of elements about the plans created as part of the I130772 protocol to determine their relationship to protocol success rate.

Methods:

For all patients on the study, the elements of the plan that were examined included: motion management strategy used, location of lesion being treated, degree of motion of the GTV throughout 10 phases of breathing cycle, treatment planning algorithm (AAA or Acuros), treatment technique (VMAT or 3DCRT), number of small apertures used, conformity index, gradient index, PTV coverage, target size, prescription dose, and modulation factor. These elements were all analyzed overall and for each motion management strategy, with additional data stratifications used as necessary.

Results:

The earliest patients treated using the I1307721 protocol received treatment in 2007 and at the most recent was in 2023. Due to the wide spread of time that patients have been treated on this protocol, many SOPs have changed which have affected how treatments are planned such as updated TPS, decrease in prevalence of the use of anesthesia and abdominal compression, and choice of treatment technique skewing more toward VMAT than 3DCRT in recent years. Despite these systematic changes, all SBRT treatments plans have certain similarities. All SBRT plans generated using the experience of the treatment team and an objective function for inverse planning. The metrics seen to be related to the success rate of each motion management strategy were related and the impact they may have on these similarities has been explored.

Conclusion(s):

The current study found that if the tumor location during treatment delivery can reliably mimic static tumor treatments such as using breath hold or compression device motion management strategies, the current study shows that PTV coverage is a viable indicator for success. These cases that attempt to treat lung tumors as static tumors are able to maintain a steady enough position that dosimetric metrics showed this effect. Additionally, this study has shown that conformity index was linked to success rate and indicated that it should approach unity and a value within the 0.95-0.96 range, with lower PTV100 may indicate under coverage. There were metrics that may inform the treatment team about which subjects are the best candidates for which motion management strategy in addition to information from 4DCT and professional experience. Other metrics found to be significant were those that may act as inputs to the inverse planning objection function.