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Helical Tomotherapy: A Fascinating Technological Concept that has Matured into Clinical Reality

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For the past seven years *Technology in Cancer Research and Treatment* has regularly introduced readers to important technological innovations in cancer medicine. *TCRT* hosted some of the earliest preclinical and clinical papers on helical tomotherapy, a technology that has since then proven itself as an invaluable modality for the treatment of malignant disease. Helical tomotherapy represents one of the earliest innovations in the presently burgeoning field of image-guided radiation therapy (IGRT). The unique design of helical tomotherapy as a hybrid between a helical CT scanner and a linear accelerator made it a natural for image-guided radiotherapy. From its inception, helical tomotherapy was fashioned as a radiation therapy delivery unit that would provide intensity modulation as opposed to a standard linear accelerator that was modified to offer this. Thus, some might consider helical tomotherapy to be the prototype of what has emerged as perhaps the most significant advance in the history of photon-based radiation therapy, image-guided intensity-modulated radiation therapy (IG-IMRT). This issue of *TCRT*, hosts several interesting and important contributions from workers investigating helical tomotherapy based IG-IMRT.

Helical tomotherapy has become an international area of research as many countries around the globe have adopted its use in the treatment of cancers. Leading off the series is a paper authored by investigators from Japan. Tomita *et al.* describe their dosimetric investigations of helical tomotherapy for brain metastases along with preliminary clinical experience. These researchers have evaluated the feasibility of helical tomotherapy for delivering a simultaneous boost to metastatic lesions while delivering whole brain radiotherapy. If proven successful in prospective clinical trials, this may have significant clinical importance since it may offer increased patient convenience and possible cost savings compared to whole brain radiotherapy followed by stereotactic radiosurgery. Additionally, the method may be an option for those patients who cannot undergo stereotactic radiosurgery because the number of metastases makes such treatment technically impractical or clinically inappropriate. Further clinical data is needed for confirmation of such a strategy.

The next paper is a contribution from the highly regarded team in London, Ontario by Schirm *et al.* Helical tomotherapy appears to be well-suited for adaptive radiotherapy given its design (1). However, like many promising concepts in medicine, it has taken time for the idea of adaptive radiotherapy to mature into a practical paradigm that is ready for clinical implementation. Here, Schirm *et al.* provide one of the earliest evaluations of the new software for adaptive radiotherapy as it approaches clinical realization.

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Next is a technical note contributed by Dr. Yi Rong and colleagues describing a method for using helical tomotherapy for breast and chestwall irradiation. Although IMRT has been advocated by several researchers (2, 3), routine implementation can be challenging because of the importance of image-guidance in this setting. Helical tomotherapy provides an IGRT solution through intrinsic image guidance, but technical aspects can sometimes be surprisingly non-intuitive. In this issue, Rong *et al.* share their particular approach to solving these technical difficulties using a simultaneous boost method that slightly reduces the overall course duration.

Rounding out the issue is a clinical contribution from the team where helical tomotherapy was conceived. Dr. Jarrod Adkinson *et al.* provide preliminary results of a potentially extremely important Phase I clinical trial evaluating the value of *biological* dose escalation in non-small cell lung cancer via a dose-per-fraction escalation method. This of course awaits further corroboration in Phase II studies but the encouraging early results hint at a significant improvement in the way non-small cell lung cancer is managed. This paper follows up nicely with earlier manuscripts published in *TCRT* describing plans to conduct such a study using helical tomotherapy (1, 4).

The surge of interest in helical tomotherapy and other forms of IG-IMRT has led to a growing number of important contributions to the cancer-related medical and technical literature. This issue represents part one of a two-part series. Stay tuned for some additional contributions from leaders in the field in the next issue of *TCRT*.

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