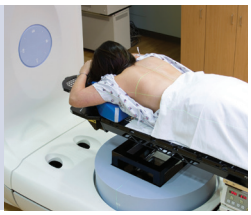
The focus of this column is to present topics of interest from a variety of journals to Oncology Nursing Forum *readers. The topics of this issue are clinical developments and future implications in the field of radiation oncology.*



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Emergence of Stereotactic Body Radiation Therapy

Stereotactic body radiation therapy (SBRT) evolved from the application of stereotactic radiosurgery, which is focused intracranial radiation. SBRT offers high doses of specific radiation with oligofractions (five or less) to a specified target, providing local control to circumscribed tumors while sparing surrounding normal tissue. Commonly treated cancers include tumors of the lung and liver. The challenge with SBRT is to account for organ motion and the achievement of precise targeting. SBRT uses three-dimensional radiation therapy planning, intensity-modulated radiation therapy, as well as image-guided organ motion and gating. SBRT is based on the premise of geometric avoidance, targeting the tumor with the goal of complete avoidance of the surrounding normal tissues and critical organs. An SBRT course of treatment ranges from one to five treatments (hypofractionated) and, therefore, differs from conventional radiation, which is usually a prolonged course ranging from two to six weeks of daily treatment.

SBRT has shown positive long-term outcomes with associated toxicities to normal tissues and proven effective repair mechanisms over time. The initial clinical experience with SBRT has been with treating primary and metastatic liver and lung tumors. The parallel functioning of these organs is ideal for early clinical models. This concept refers to organs with similar parenchymal tissue subdivisions and independent functions. In this way, if a circumscribed lesion is treated in one lung lobe, then another lobe can continue to function if long-term side effects occur. Appropriate candidates for SBRT are those with early-stage lung cancer who are considered poor surgical candidates as well as patients with inoperable lung lesions that are small and solitary. Historically, standard radiation had poor outcomes and SBRT was used to control the disease in these patient populations.

Primary tumor control rates with SBRT ranged from 80% to greater than 90%, which was about double the rates of conventional radiation. In addition, rates of severe toxicity were low (15%–20%), which was a sentinel finding for SBRT. This patient population would not have had viable therapeutic alternatives before.

SBRT has been used for early-stage inoperable lung cancer, lung metastasis, primary and metastatic liver cancer, pancreatic cancer, adrenal metastases, and primary kidney cancer. Future trials are looking at the use of SBRT for prostate cancer with a focus on dose escalation while protecting adjacent organs.

The use of SBRT has become widespread in academic- and community-based radiation oncology centers. The focus remains on the treatment of inoperable or metastatic disease from either lung or liver primaries because those are the areas of greatest clinical expertise. The potential for expansion of SBRT indications depends on continued trials to study long-term side effects of hypofractionation.

Timmerman, R.D., Herman, J., & Cho, L.C. (2014). Emergence of stereotactic body radiation therapy and its impact on current and future clinical practice. *Journal of Clinical Oncology, 32,* 2847–2854. doi:10.1200.JCO.2014.55.4675

Molecular Radiobiology

Molecular radiobiology is the science of the concomitant administration of targeted therapies with radiation to enhance radiation therapy effect and diminish surrounding normal tissue and organ toxicity. Combined modality treatment with conventional cytotoxic agents has focused on the interruption of DNA replication of cancer cells as an adjunct to radiation. Although the treatment paradigm is effective, it causes a variety of dose-limiting toxicities of vital normal cells. New tumor-specific biologic agents have been identified and have the ability to minimize normal cellular injury, enhance tumor cell kill, and potentially broaden the scope of radiation therapy to treat systemic metastatic disease.

The field of molecular radiobiology has been identified as pivotal for achieving genetic-based treatment interventions in radiation oncology. Radiation therapy equipment and delivery techniques may soon reach a plateau, and the need to focus on the combination of molecular-targeted agents with radiation could provide new and effective therapeutic options.

One of the first studies of targeted therapy given with radiation was with the radioresistance of the *Ras* oncogene in rodent cells, which led to clinical trials focusing on the development of *Ras* as a radiosensitizer. This had clinical applicability with a small cohort of patients with head and neck cancer and non-small cell lung cancer. Although not sustained, this was the first work that established the potential of combining targeted agents with radiation therapy to achieve tumoricidal effects while sparing normal tissue.

Another example of this early work was the coupling of epidermal growth factor receptor (EGFR) antibody with radiation therapy for squamous cell cancer of the head and neck. A well-known phase III study combining EGFR with radiation therapy showed a statistically significant increase in progression-free and overall survival compared to radiation alone. These early findings supported the work of molecular radiobiology and indicated that biologic modifiers can enhance the therapeutic

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