First prospective clinical trial of adaptive radiotherapy for head and neck cancer patients

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Researchers led by a senior investigator at Hofstra-North Shore LIJ School of Medicine and The Feinstein Institute for Medical Research have released initial findings from a first-of-a-kind clinical trial in adaptive radiotherapy (ART) for head and neck cancer. The trial, sponsored by the National Cancer Institute, provides evidence that ART may benefit patients with less technical difficulty than previously believed. The findings of this trial were released online in advance of publication in the *International Journal of Radiation Oncology Biology Physics*.

Physicians commonly use radiotherapy to treat squamous cell carcinoma of the oropharynx (back of throat). Current standard-of-care treatment is called intensity-modulated radiotherapy, or IMRT. IMRT allows physicians to "sculpt" radiation to fit the anatomy of individual patients. Although appealing, this technique has a crucial Achilles' heel – it is based entirely on a CT or MRI scan taken before actual treatment begins. Since a typical course of radiation treatment for oropharynx cancer lasts 6-7 weeks, standard IMRT cannot compensate for common changes that take place in a patient's body during this time, such as weight loss, shrinkage of tumor, or gradual movement of normal tissues. Recent work suggests that the inability of standard IMRT to keep up with these changes may lead to unanticipated toxicity, or potentially worse, missing of tumor.

For this new trial, which was conducted at the University of Texas M.D. Anderson Cancer Center, investigators started patients on standard IMRT. They then took CT scans while patients were lying in the radiation treatment room each day so they could monitor changes in tumor and normal tissues during the entire course of treatment. Through computerized techniques, the investigators "adapted" (thus the name "adaptive radiotherapy") treatment if they noticed significant tumor or body changes that could affect quality of treatment. Most strikingly, the group found that most patients required only one, or at most two adaptions of IMRT to maintain treatment quality.

"This is the first prospective clinical trial of its kind to gauge how "refitting" of IMRT to a patient's body actually impacts care for a patient who has head and neck cancer," noted David Schwartz, MD, vice-chair of radiation medicine at the North Shore-LIJ Health System, associate professor at the Hofstra North Shore-LIJ School of Medicine, and a senior investigator at The Feinstein Institute for Medical Research. "What most encouraged us was that ART appears effective with only 1 or 2 additional replans. This means that ART does not have to be overly burdensome or expensive to make a difference. This is something that is feasible, and could eventually make a real-world difference in many clinics."

"ART keeps radiation treatment tightly fitted to a patient's body, almost as if it were being shrink-wrapped," Schwartz added. "It is as individualized as our current treatment can realistically be."

Specifics of the Trial

Twenty-four patients enrolled onto this institutional review board approved trial; data for 22 of these patients were analyzed with at least 12 months follow-up. Treatment was initiated with a baseline IMRT plan, and computed tomography (CT) imaging was performed in the

treatment room each day to map tumors and normal anatomy to assess need for ART replanning.

Primary site was base of tongue in 15 patients, tonsil in 6 patients, and glossopharyngeal sulcus in one patient. Twenty patients (91 percent) had American Joint Committee on Cancer (AJCC) Stage IV disease. T stage distribution was 2 T1, 12 T2, 3 T3, 5 T4. N stage distribution was 1 N0, 2 N1, 5 N2a, 12 N2b, and 2 N2c. Of the patients, 21 (95%) received systemic therapy.

All patients required at least one ART replan because of tumor and normal tissue changes; eight patients (36 percent) required a second ART replan. For the patients who required one adaptive replan, parotid salivary glands had shrunk by an average of 16 percent and tumors had shrunk by five percent by the time of the replan. For the patients who required a second adaptive replan, parotid glands and tumors had shrunk by 24 percent and 14 percent, respectively. Most ART replans were completed within one day.

With a 31-month median follow-up, there has been no primary site failure and one nodal relapse, yielding 100 percent local and 95 percent regional disease control at two years. Chronic toxicity and functional outcomes beyond one year remain favorable relative to published results for standard IMRT.

Provided by North Shore-Long Island Jewish (LIJ) Health System