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## Challenges and prospects of adaptive radiation therapy in head and neck cancer

**Heming Lu**

People's Hospital of Guangxi Zhuang Autonomous Region, China

Intensity-modulated radiation therapy (IMRT) has now replaced conventional radiation therapy and three-dimensional radiation therapy and become a standard treatment technique for head and neck cancer. This technique provides adequate target coverage while maintaining steep dose gradients at the border between the targets and adjacent normal tissues. However, significant anatomic changes may occur throughout the entire treatment course. These changes include the shrinkage of the primary disease and metastatic lymph nodes, external contour because of significant weight loss and displacement/size of the normal structures. As a consequence, the initial planning based on pretreatment condition may not truly reflect the dosimetric variations during the course of IMRT. Thus adaptive radiation therapy (ART), a plan modification and implementation according to tumor response and anatomic changes of normal structures, becomes particularly important. In recent years, many researchers have focused on ART for head and neck cancer patients. Results from dosimetric studies suggest that the initiation of ART during fractionated IMRT provides various benefits, particularly in preventing overdose to the critical structures. The feasibility of ART in clinical practice, both in online and in offline settings, has been broadly reported in the literature. However, many questions remain unanswered: Who would benefit most for ART? What is the optimal timing and frequency to perform ART? Whether ART re-planning can transfer into clinical benefits? Mature outcomes from basic and clinical researches will be necessary to appropriately mold ART into a future treatment standard.

[luhming3632@163.com](mailto:luhming3632@163.com)

## Conscientious medical imaging: To image or not to image

**Jun Deng**

Yale University School of Medicine, USA

Medical imaging has revolutionized medical practices in the past hundred years, particularly in the radiotherapeutic management of cancers where anatomical and functional imaging procedures are applied routinely in the clinic worldwide for more precise tumor targeting and better soft tissue visualization. Yet, driven largely by technological advances as well as a fee-for-service healthcare model, the use of medical imaging modalities in cancer diagnosis and radiotherapy has increased dramatically in the past thirty years. Moreover, while modern cancer therapy is shifting toward individualized treatments based on patient-specific biology, the application of imaging procedures in cancer radiotherapy remains non-personalized: a 'one-protocol-fits-all' practice is often applied in the clinic worldwide. Essentially, the imaging protocols provided by manufacturers are uniformly applied without considering individual differences of patients being scanned. As such, radiation exposure to individuals from medical imaging nowadays has increased over 8 times since 1980, which may become a serious public health concern due to increased secondary cancer risk. Whether to image and how to image an individual patient; is not only an ongoing technical issue but also becoming an ethical concern in the clinic. In meeting these challenges, personalized imaging protocol could assist clinicians in making the best use of medical imaging with their patients worldwide. This lecture will address the trend and issues of medical imaging in the US and around the world and highlight approaches to apply medical imaging more conscientiously in the clinic to minimize radiation exposure and cancer risk, reduce medical costs and improve patient care.

[jun.deng@yale.edu](mailto:jun.deng@yale.edu)