AbstractID: 7869 Title: Quality Assurance for IMRT and IGRT

Image-guided radiation treatment (IGRT) units are now available in the community and are capable of routine clinical use, offering unprecedented level of precision and accuracy in treatment delivery. These systems bring a substantial change in clinical practice for all the disciplines involved in radiation medicine. One can now correct patient position using image information displaying not only bony anatomy and airways, like portal imaging, but also implanted markers, soft tissue structures within the patient, and sometimes the target to be irradiated. Growing experience with kilovoltage IGRT systems has demonstrated the ability to verify, on a daily basis, the position of internal anatomy structures with respect to the treatment beam geometry for several anatomical sites. Kilovoltage IGRT systems further allow, using daily imaging sessions, on-line correction of patient translations and rotations, and the comparison for successive daily volumetric images permits to track changes of anatomy through the course of therapy. Introducing kV systems within busy radiation therapy clinics requires thoughtful testing and quality assurance protocols (QA) of the device, and judicious modification of existing radiation therapy processes and protocols. While the modes of use of these novel systems will continue to evolve into the distant future, their performance needs to be of the highest level, as they will be depended upon in the treatment process.

There are two key features of the kilovoltage IGRT systems require particular attention: geometric accuracy and image quality. First, the kilovoltage IGRT system may not share a common central axis with the megavoltage treatment beam; therefore, the geometric relation of the kilovoltage imaging datasets to the megavoltage treatment beam must be assessed and monitored to ensure adequate localization, scaling, and geometric accuracy. Second, image quality metrics define the ability of the kilovoltage IGRT system to consistently produce an image of sufficient quality to localize the structures of interest. A well-planned QA program integrates closely the IGRT system procedures with linac procedures described in accepted QA standards such as the AAPM task group 40 report.

This lecture will present a brief review of kilovoltage IGRT systems, and will focus on a suitable QA program, with special emphasis on issues germane to the system and the clinical processes relying on its use. Daily and monthly procedures, with phantoms constructed for these QA activities, will be suggested, and some quality assurance metrics, with their associated tolerance levels based on three years of experience on such devices will be presented. These levels are based on data accumulated over four years of experience on ten linear accelerators equipped with kilovoltage IGRT devices in our multi-vendor environment. Successful strategies for clinical implementation of IGRT will also be discussed.

Educational objectives:

1. Understand the technical issues related to kV systems
2. Understand the impact of kV systems on clinical processes
3. Present a comprehensive commissioning protocol and QA program for kV systems.

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